Imperial Solar Energy Center South

Appendix C1

Construction Air Quality Conformity Assessment

Prepared by Investigative Science and Engineering, Inc.

August 17, 2010

CONSTRUCTION AIR QUALITY CONFORMITY ASSESSMENT
IMPERIAL SOLAR ENERGY CENTER SOUTH
IMPERIAL COUNTY, CA

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INTRODUCTION AND DEFINITIONS

Existing Site Characterization

The subject project site consists of approximately 903 acres of privately owned, undeveloped agricultural land, in the unincorporated Mt. Signal area of the County of Imperial, approximately eight miles southwest of the City of El Centro (refer to Figure 1 on the following page). The property is located south of Anza Road, north of Cook Road, and is generally bisected by Pullman Road. The project site consists of six parcels, namely, Assessor Parcel Numbers (APN): 052-190- 021; 052-190-022; 052-190-023; 052-190-033; 052-190-034; and, 052-190-037.

The United States international border with the Republic of Mexico is located immediately south of the project site. Federal lands under jurisdiction of the Bureau of Land Management (BLM) are located immediately west of the project site. The property is designated by the County of Imperial General Plan as “Agriculture” and is zoned A-3 – Heavy Agriculture and A-2-R-General Agricultural Rural Zone. The site is currently utilized for alfalfa production as shown in Figure 2 on Page 3. Elevations across the site range from approximately 0 to 10 feet above mean sea level (MSL).

Project Description

The electricity generation process associated with the proposed project would utilize clean solar photovoltaic (PV) technology to convert sunlight directly into electricity. Under this technology, groups of photovoltaic modules are wired together to form a photovoltaic array. The PV arrays convert solar radiation into direct current (DC) electricity. The direct current from the array is collected at an inverter where the current is converted to phase and impedance adjusted alternating current (AC) for use within the electrical grid. The output from the inverter then flows through a step-up transformer before it reaches the transmission and distribution system. The proposed Imperial Solar Energy Center South site would have a nominal rated capacity of 200 megawatts (MW).

The major generation equipment comprising the photovoltaic electrical generation system includes PV solar modules; a panel racking and foundation design; inverter and transformer station; an electrical collection system; and a switchyard. The proposed design for the Imperial Solar Energy Center South site is shown in Figure 3 on Page 4 of this report.

Finally, the proposed photovoltaic facility site is located approximately five miles south of the existing Imperial Valley Substation. The photovoltaic facility would interconnect to the utility grid at the 230 kV side of the Imperial Valley Substation via an approximately five-mile long, 120-foot wide transmission line within lands maintained by the U.S. Bureau of Land Management.

FIGURE 1: Project Area Vicinity Map (ISE 8/10)

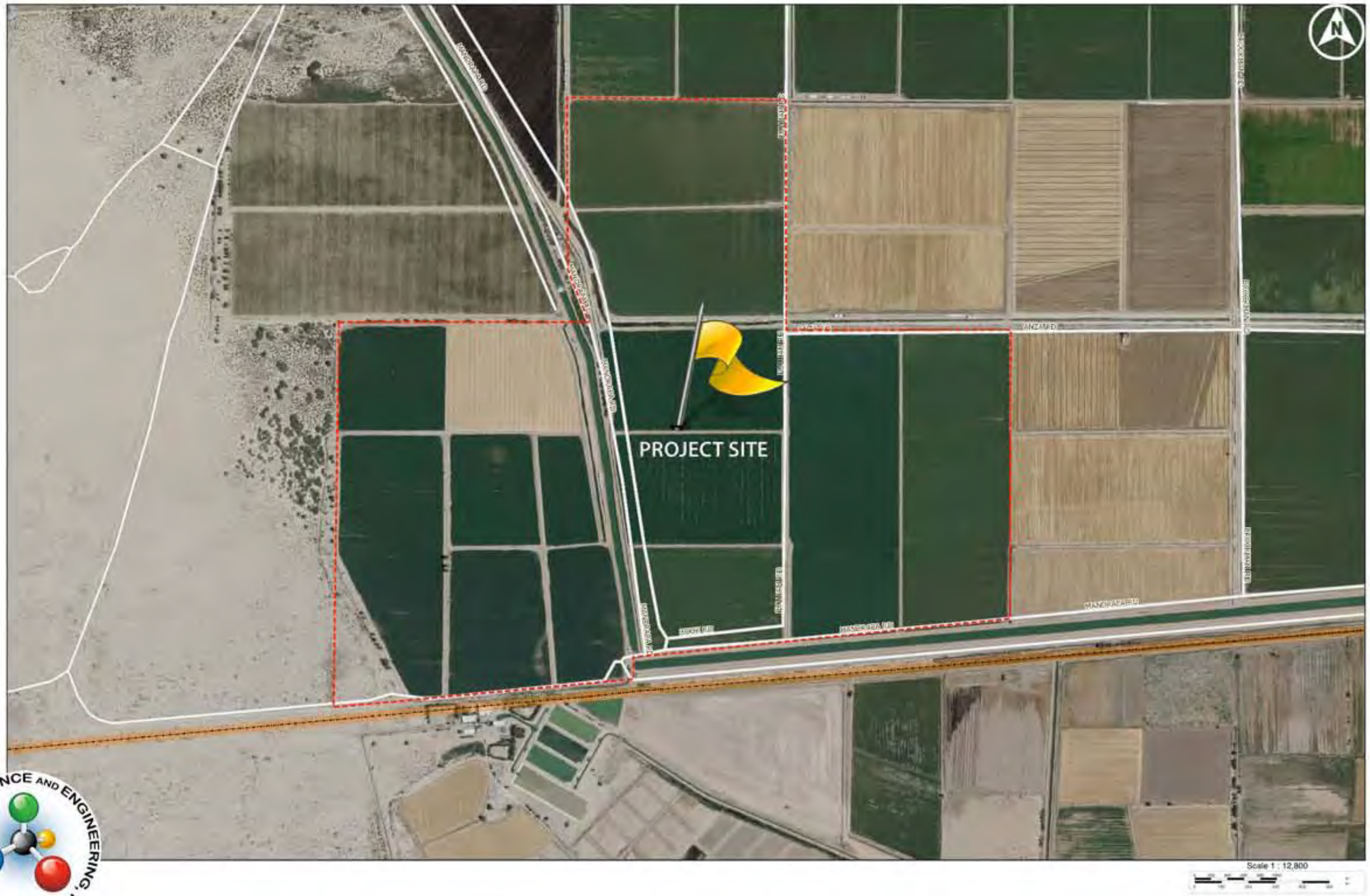

FIGURE 2: Imperial Solar Energy Center South Site Map (ISE 8/10)

FIGURE 3: Conceptual Facility Site Plan (Zachry Engineering 2010)

Air Quality Definitions

Air quality is defined by ambient air concentrations of specific pollutants determined by the Environmental Protection Agency (EPA) to be of concern with respect to the health and welfare of the public. The subject pollutants, which are monitored by the EPA, are Carbon Monoxide (CO), Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Ozone (O_3), respirable 10- and 2.5-micron particulate matter (PM_{10}), Volatile Organic Compounds (VOC), Reactive Organic Gasses (ROG), Hydrogen Sulfide (H_2S), sulfates, lead, and visibility reducing particles.

Examples of sources and effects of these pollutants are identified starting below as:

- Carbon Monoxide (CO): Carbon monoxide is a colorless, odorless, tasteless and toxic gas resulting from the incomplete combustion of fossil fuels. CO interferes with the blood's ability to carry oxygen to the body's tissues, and results in numerous adverse health effects. CO is a criteria air pollutant.

- Oxides of Sulfur (SO_x): Typically strong smelling, colorless gases that are formed by the combustion of fossil fuels. SO_2 and other sulfur oxides contribute to the problem of acid deposition. SO_2 is a criteria pollutant.

- Nitrogen Oxides (Oxides of Nitrogen, or NO_x): Nitrogen oxides (NO_x) consist of nitric oxide (NO), nitrogen dioxide (NO_2), and nitrous oxide (N_2O); these are formed when nitrogen (N_2) combines with oxygen (O_2). Their lifespans in the atmosphere range from one to seven days for nitric oxide and nitrogen dioxide, and 170 years for nitrous oxide. Nitrogen oxides are typically created during combustion processes, and are major contributors to smog formation and acid deposition. NO_2 is a criteria air pollutant, and may result in numerous adverse health effects. It absorbs blue light, resulting in a brownish-red cast to the atmosphere and reduced visibility.

- Ozone (O_3): A strong smelling, pale blue, reactive toxic chemical gas consisting of three oxygen atoms. It is a product of the photochemical process involving the sun's energy. Ozone exists in the upper atmosphere ozone layer, as well as at the earth's surface. Ozone at the earth's surface causes numerous adverse health effects and is a criteria air pollutant. It is a major component of smog.

- PM_{10} (Particulate Matter less than 10 microns): A major air pollutant consisting of tiny solid or liquid particles of soot, dust, smoke, fumes, and aerosols. The size of the particles (10 microns or smaller, about 0.0004 inches or less) allows them to easily enter the lungs, where they may be deposited, resulting in adverse health effects. PM_{10} also causes visibility reduction and is a criteria air pollutant.

- $PM_{2.5}$ (Particulate Matter less than 2.5 microns): A similar air pollutant consisting of tiny solid or liquid particles which are 2.5 microns or smaller (often referred to as fine particles). These particles are formed in the atmosphere from primary gaseous emissions that include sulfates formed from SO_2 release from power plants and industrial facilities, and nitrates that are formed from NO_x release from power plants, automobiles and other types of combustion sources. The chemical composition of fine particles highly depends on location, time of year, and weather conditions.

- Volatile Organic Compounds (VOC): Volatile organic compounds are hydrocarbon compounds (any compound containing various combinations of hydrogen and carbon atoms) that exist in the ambient air. VOC's contribute to the formation of smog through atmospheric photochemical reactions and/or may be toxic. Compounds of carbon (also known as organic compounds) have different levels of reactivity; that is, they do not react at the same speed or do not form ozone to the same extent, when exposed to photochemical processes. VOC's often have an odor, and some examples include gasoline, alcohol, and the solvents used in paints. Exceptions to the VOC designation include: carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate.

- Reactive Organic Gasses (ROG): Similar to VOC, Reactive Organic Gasses (ROG) are also precursors in forming ozone, and consist of compounds containing methane, ethane, propane, butane, and longer chain hydrocarbons which are typically the result of some type of combustion/decomposition process. Smog is formed when ROG and nitrogen oxides react in the presence of sunlight.

- Hydrogen Sulfide (H_2S): A colorless, flammable, poisonous compound having a characteristic rotten-egg odor. It often results when bacteria break down organic matter in the absence of oxygen. High concentrations of 500-800 ppm can be fatal and lower levels cause eye irritation and other respiratory effects.

- Sulfates: An inorganic ion that is generally naturally occurring and is one of several classifications of minerals containing positive sulfur ions bonded to negative oxygen ions.

- Lead: A malleable, metallic element of bluish-white appearance that readily oxidizes to a grayish color. Lead is a toxic substance that can cause damage to the nervous system or blood cells. The use of lead in gasoline, paints, and plumbing compounds has been strictly regulated or eliminated, such that today it poses a very small risk.

- Visibility Reducing Particles (VRP): VRP's are just what the name implies, namely, small particles that occlude visibility and/or increase glare or haziness. Since sulfate emissions (notably SO_2) have been found to be a significant contributor to visibility-reducing particles, Congress mandated reductions in annual emissions of SO_2 from fossil fuels starting in 1995.

The EPA has established ambient air quality standards for these pollutants. These standards are called the National Ambient Air Quality Standards (NAAQS).[1] The California Air Resources Board (CARB) subsequently established the more stringent California Ambient Air Quality Standards (CAAQS).[2] Both sets of standards are shown in Figure 4 on the following page. Areas in California where ambient air concentrations of pollutants are higher than the state standard are considered to be in *"non-attainment"* status for that pollutant.

[1] Under the Federal Clean Air Act of 1970, amended in 1977.

[2] The new CARB eight-hour ozone standard became effective in early 2006. The new federal $PM_{2.5}$ standard became effective in early 2007.

Pollutant	Averaging Time	California Standards		Federal Standards		
		Concentration	Method	Primary	Secondary	Method
Ozone (O_3)	1 Hour	0.09 ppm (180 μg/m^3)	Ultraviolet Photometry	—	Same as Primary Standard	Ultraviolet Photometry
	8 Hour	0.070 ppm (137 μg/m^3)		0.075 ppm (147 μg/m^3)		
Respirable Particulate Matter (PM10)	24 Hour	50 μg/m^3	Gravimetric or Beta Attenuation	150 μg/m^3	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	20 μg/m^3		—		
Fine Particulate Matter (PM2.5)	24 Hour	No Separate State Standard		35 μg/m^3	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	12 μg/m^3	Gravimetric or Beta Attenuation	15.0 μg/m^3		
Carbon Monoxide (CO)	8 Hour	9.0 ppm (10mg/m^3)	Non-Dispersive Infrared Photometry (NDIR)	9 ppm (10 mg/m^3)	None	Non-Dispersive Infrared Photometry (NDIR)
	1 Hour	20 ppm (23 mg/m^3)		35 ppm (40 mg/m^3)		
	8 Hour (Lake Tahoe)	6 ppm (7 mg/m^3)		—	—	—
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	0.030 ppm (57 μg/m3)	Gas Phase Chemiluminescence	0.053 ppm (100 μg/m^3)	Same as Primary Standard	Gas Phase Chemiluminescence
	1 Hour	0.18 ppm (339 μg/m^3)		—		
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	—	Ultraviolet Fluorescence	0.030 ppm (80 μg/m^3)	—	Spectrophotometry (Pararosaniline Method)
	24 Hour	0.04 ppm (105 μg/m^3)		0.14 ppm (365 μg/m^3)	—	
	3 Hour	—		—	0.5 ppm (1300 μg/m^3)	
	1 Hour	0.25 ppm (655 μg/m^3)		—	—	—
Lead	30 Day Average	1.5 μg/m^3	Atomic Absorption	—	—	—
	Calendar Quarter	—		1.5 μg/m^3	Same as Primary Standard	High Volume Sampler and Atomic Absorption
	Rolling 3-Month Average	—		0.15 μg/m^3		
Visibility Reducing Particles	8 Hour	Extinction coefficient of 0.23 per kilometer — visibility of ten miles or more (0.07 — 30 miles or more for Lake Tahoe) due to particles when relative humidity is less than 70 percent. Method: Beta Attenuation and Transmittance through Filter Tape.		No Federal Standards		
Sulfates	24 Hour	25 μg/m^3	Ion Chromatography			
Hydrogen Sulfide	1 Hour	0.03 ppm (42 μg/m^3)	Ultraviolet Fluorescence			
Vinyl Chloride	24 Hour	0.01 ppm (26 μg/m^3)	Gas Chromatography			

FIGURE 4: Ambient Air Quality Standards Matrix (after CARB/EPA, updated 11/17/08)

THRESHOLDS OF SIGNIFICANCE

California Environmental Quality Act (CEQA) Thresholds

Section 15382 of the California Environmental Quality Act (CEQA) guidelines defines a significant impact as,

> *"… a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance."*

The ambient air quality standards within Imperial County, as identified by the Imperial County Air Pollution Control District (ICAPCD), are outlined in the ICAPCD Criteria Pollutant Standards section below.

CEQA Air Quality Screening Standards

The County of Imperial uses Appendix G.III of the State CEQA guidelines as thresholds of significance, and recognizes the Imperial County Air Pollution Control District (ICAPCD) CEQA thresholds as screening standards. These standards focus on the following potential impact areas, namely, would the project:

a) Conflict with, or obstruct, implementation of the applicable air quality plan?

b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?

c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is in non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?

d) Expose sensitive receptors to substantial pollutant concentrations?

e) Create objectionable odors affecting a substantial number of people?

These screening standards will be applied throughout this air quality conformity assessment for the basis of determination of both regional, as well as localized, air quality impacts due to the proposed project.

ICAPCD Criteria Pollutant Standards

Significance criteria for stationary and mobile source air quality impacts are based upon the approach recommended by the California Air Resources Board (CARB) and the ICAPCD. ICAPCD establishes emission thresholds for determining the potential significance of a proposed action. For CEQA purposes, these screening criteria are used as numeric methods to demonstrate that a project's total emissions (e.g. stationary and fugitive emissions, as well as emissions from mobile sources) would not result in a significant impact to air quality.

The applicable standards are shown quantitatively in Table 1 below. The existing ambient conditions are compared for the with- and without project cases. If emissions exceed the allowable thresholds, additional analysis is conducted to determine whether the emissions would exceed an ambient air quality standard (i.e., the CAAQS values previously shown in Figure 4 above).

TABLE 1: Thresholds of Significance for Air Quality Impacts – ICAPCD

Pollutant	Thresholds of Significance	
Carbon Monoxide (CO)	**550**	100
Oxides of Nitrogen (NO_x)	**55**	50
Oxides of Sulfur (SO_x)	**150**	100
Particulate Matter (PM_{10})	**150**	100
Particulate Matter ($PM_{2.5}$)	**55**	100
Volatile Organic Compounds (VOC's) Reactive Organic Gasses (ROG's)	**55**	50

- Source: ICAPCD 2007; EPA 40 CFR 93, 1993.
- The PM2.5 threshold is based upon the proposed standard identified in the *"Final – Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds"*, published by SCAQMD in October 2006.

Determination of significance considers both localized impacts and cumulative impacts. In the event that any criteria pollutant exceeds the threshold levels, the proposed action's impact on air quality is considered significant, and mitigation measures would be required.

It should be noted that ICAPCD has adopted, as part of their current November 2007 CEQA guidelines, standard mitigation measures for construction emissions, which must be followed regardless of the size of the project. Thus, the above levels are used for screening purposes and the project applicant would be required to utilize the measures provided under the Conclusions and Recommendations section of this report regardless of the impact findings.

Finally, it should be noted that under the General Conformity Rule, the EPA has developed a set of *de minimis* thresholds for all proposed federal actions in a non-attainment area for evaluating the significance of air quality impacts. It should be noted that the State standards are equal to, or more stringent than, the Federal Clean Air standards[3]. Development of the proposed project would therefore fall under the stricter ICAPCD guidelines.

[3] A fact that can be verified through multiplication of the ICAPCD standards by 365 days and dividing by 2,000 pounds.

Combustion Toxics Risk Factors

When fuel burns in an engine, the resulting exhaust is made up of soot and gases representing hundreds of different chemical substances. The predominant constituents are:

- Nitrous Oxide
- Formaldehyde
- Sulfur Dioxide
- Carbon Dioxide
- Nitrogen Dioxide
- Benzene
- Hydrogen Sulfide
- Carbon Monoxide

Over ninety-percent (90%) of the exhaust emissions from an engine consist of soot particles whose size is equal to, or less than, 10-microns in diameter. Particles of this size can easily be inhaled and deposited in the lungs. Diesel exhaust contains roughly 20 to 100 times more emissive particles than gasoline exhaust. Of principal concern are particles of cancer causing substances known as *polynuclear aromatic hydrocarbons* (PAH's).[4]

There are inherent uncertainties in risk assessment with regard to the identification of compounds as causing cancer or other adverse health effects in humans, the cancer potencies and Reference Exposure Levels (REL's)[5] of compounds, and the exposure that individuals receive. It is common practice to use conservative (health protective) assumptions with respect to uncertain parameters. The uncertainties and conservative assumptions must be considered when evaluating the results of risk assessments.

Since the potential health effects of contaminants are commonly identified based on animal studies, there is uncertainty in the application of these findings to humans. In addition, for many compounds it is uncertain whether the health effects observed at higher exposure levels in the laboratory or in occupational settings will occur at lower environmental exposure levels. In order to ensure that potential health impacts are not underestimated, it is commonly assumed that effects seen in animals, or at high exposure levels, could potentially occur in humans following low-level environmental exposure.

Estimates of potencies and REL's are derived from experimental animal studies, or from epidemiological studies of exposed workers or other populations.[6] Uncertainty arises from the application of potency, or REL values derived from this data, to the general human population. There is debate as to the appropriate levels of risk assigned

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[4] Polynuclear aromatic hydrocarbons (PAH's) are hydrocarbon compounds with multiple benzene rings. PAH's are a group of approximately 10,000 compounds which result predominately from the incomplete burning of carbon-containing materials like oil, wood, garbage or coal.

[5] The exposure level at which there are no biologically significant increases in the frequency or severity of adverse effects between the exposed population and the control group. Some effects may be produced at this level, but they are not considered adverse or precursors to adverse effects.

[6] Source: *CalEPA, USEPA, SCAQMD, 2001 et. seq.*

to diesel particulates, since the USEPA has not yet declared diesel particulates as a toxic air contaminant.

Using the CARB threshold, a risk concentration level of one in one million (1:1,000,000) of continuous 70-year exposure is considered less than significant. A risk exposure level of ten in one million (10:1,000,000) is acceptable if Toxic Best Available Control Technologies (T-BACT's) are used. It should be noted that this type of reporting is only strictly applicable to large populations (such as entire air basins), where the sample group is sizeable, and the exposure time is long (which is not the case for project-level construction projects).

For purposes of analysis under this report, and to be consistent with the approaches used for other toxic pollutants, a functional comparison of the aforementioned risk probability per individual person exposed to construction contaminants will be examined. This approach has the advantage of not needing to quantify the population of the statistical group adjacent to the construction (which could yield false values), as well as allowing the per-person risk to be expressed as a final percentage (with a percentage level of 100% being equal to the impact threshold). Of course, for a large enough population sample (i.e., a million people or more) the results are identical to CARB's prediction methodology.

ANALYSIS METHODOLOGY

The analysis criteria for air quality impacts are based upon the approach recommended by the *South Coast Air Quality Management District's (SCAQMD) CEQA Handbook*.[7] The handbook establishes aggregate emission calculations for determining the potential significance of a proposed action. In the event that the emissions exceed the established thresholds, air dispersion modeling may be conducted to assess whether the proposed action results in an exceedance of an air quality standard. The County of Imperial has adopted this methodology.

Ambient Air Quality Data Collection

CARB Air Monitoring Station Data within Project Vicinity

The California Air Resources Board (CARB) monitors ambient air quality at approximately 250 air-monitoring stations across the state. Air quality monitoring stations usually measure pollutant concentrations 10 feet above ground level; therefore, air quality is often referred to in terms of ground-level concentrations. Ambient air pollutant

[7] The SCAQMD CEQA Handbook is a reference volume containing an extensive list of semi-empirical (quantified experimental) curve-fit equations describing various emissive sources having important context under CEQA. The equations are not perfect (in that they would not constitute an *'exact solution'* in a scientific sense), but are nonetheless a reasonable approximation of the physical problem. In the same light, programs which utilize the SCAQMD semi-empirical methodology (such as *URBEMIS 2007* and the like) provide no greater problem understanding than using the equations directly. Such programs are still subject to all of the same limitations as the methods and equations on which they rely.

concentrations in the Salton Sea Air Basin are measured at seven air-quality-monitoring stations operated by either ICAPCD or CARB.

The nearest ambient air-quality-monitoring stations (denoted by the symbol in Figure 5 on the following page) in close proximity to the project site are located within the City of Calexico approximately 10.4 miles from the project site and within the City of El Centro approximately 10.7 miles distant.[8,9] The Calexico station currently records CO, SO_2, NO_2, O_3, PM_{10}, and $PM_{2.5}$ while the El Centro station records CO, NO_2, O_3, PM_{10}, $PM_{2.5}$, Both stations record various meteorological parameters such as barometric pressure, wind speed, etc.

Other stations within the project vicinity present either incomplete or redundant data, or were determined not to be representative of localized ambient air quality conditions present at the project site. Due to the type of equipment employed at each station, not every station is capable of recording the entire set of criteria pollutants previously identified in Table 1. Periodic audits are conducted to ensure calibration conformance.[10]

Onsite Air Quality Monitoring and Analysis

Additionally, ambient air samples were collected at the project site at a height of 5.0-feet above the current ground level using a negative pressure sampling apparatus. The testing locations are shown in Figure 6 on Page 14 of this report. Each air sample was collected in a 0.7-liter Teflon sample (Tedlar) bag[11], and sealed upon completion of testing. Onsite testing conditions indicated an ambient dry-bulb air temperature of 104.0 degrees Fahrenheit and relative humidity of 48.0 percent. The samples were maintained under *Standard Temperature and Pressure Conditions* (STP) during transit to the ISE test facility.

The bagged sample was tested for airborne toxics, as well as molecular composition using a Stanford Research Systems 300 AMU Universal Gas Analyzer (or UGA).[12] This device, which consists of a Faraday cup quadrupole mass spectrometer, analyzes incoming gasses (or any material that can be aerosolized) for content based upon its atomic distribution. In this manner, the UGA analyzes any substance based solely upon its elemental composition.

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[8] Calexico Station (1029 Belcher St, Calexico CA 92231) – ARB Station ID 13698.

[9] El Centro Station (150 9th St, El Centro CA 92243) – ARB Station ID 13694.

[10] Calibration of CARB equipment is performed in accordance with the *U.S. Environmental Protection Agency's 40 CFR, Part 58, Appendix A* protocol with all equipment traceable to National Institute of Standards and Technology (NIST) standards. The typical accuracy of the equipment is ±15% for gasses (such as CO, NO_x, etc.) and ±10% for PM_{10}.

[11] SKC Cat #232-945A.

[12] The designator AMU stands for Atomic Mass Unit, and is a measure of the atomic weight of a particular element (i.e., the combined nuclear weight of an element's protons and neutrons).

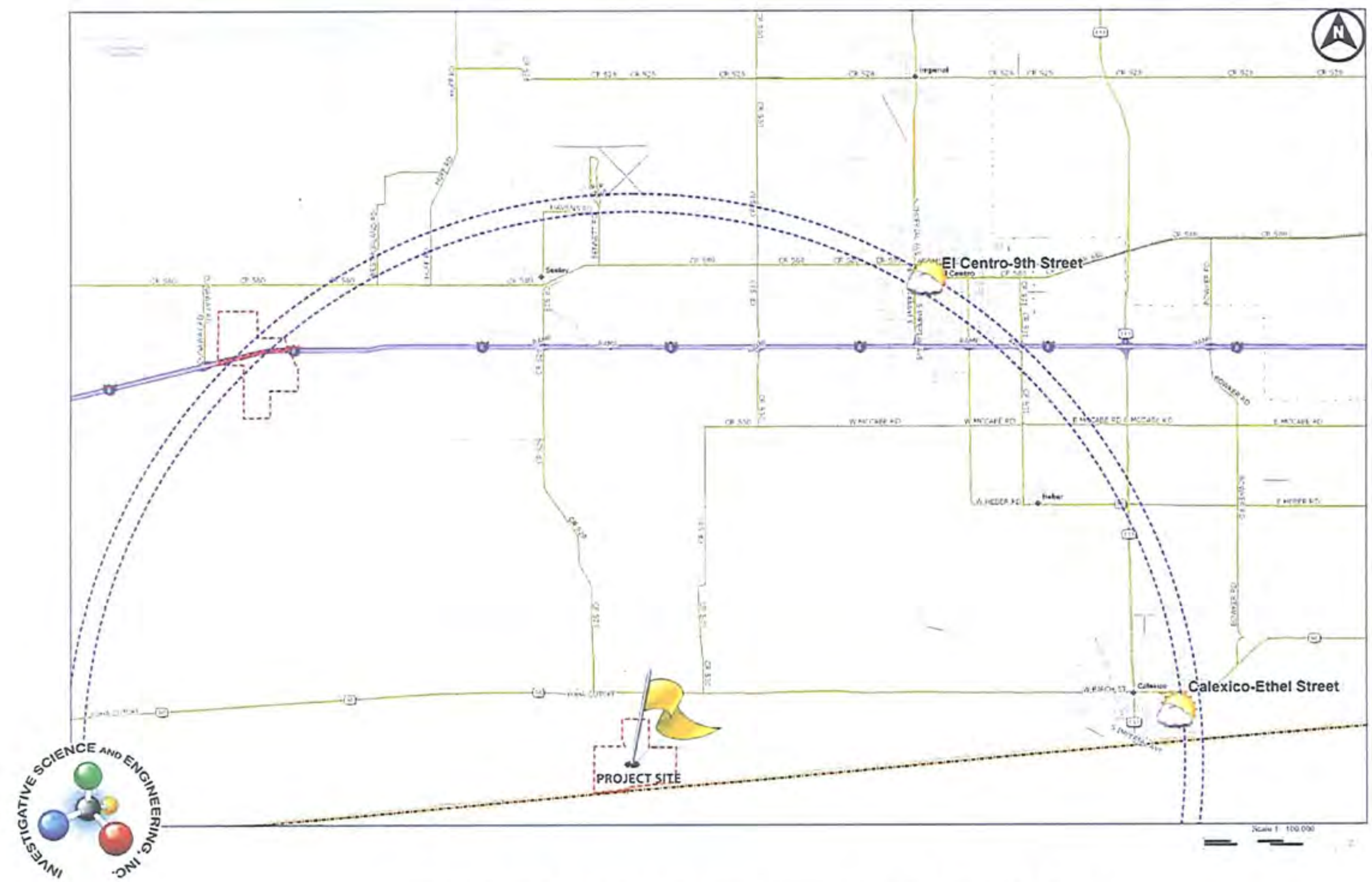

FIGURE 5: Ambient Air Quality Monitoring Station Location Map (ISE 8/10)

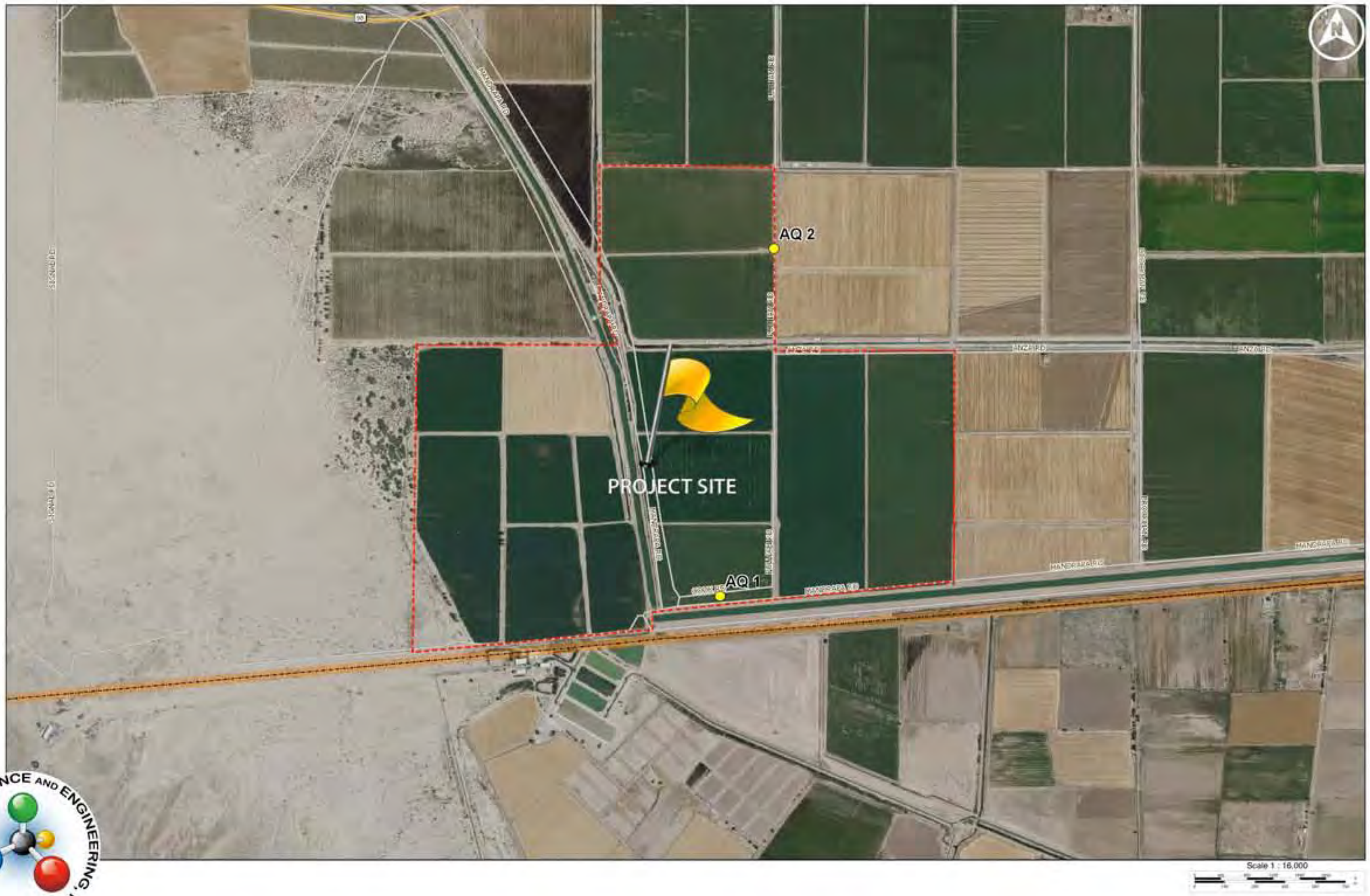

FIGURE 6: Onsite Air Quality Sampling Location Map (ISE 7/10)

Data from the UGA was then post processed using a process known as *spectral deconvolution* to determine the relative composition of any toxics of interest. A final screening the data against 191,436 different compounds was performed using the 2008 National Institute of Standards and Technology (NIST08) Mass Spectral Library search program.

Construction Air Quality Modeling

Construction Vehicle Emission Modeling (CO, NO_x, SO_x, PM_{10}, $PM_{2.5}$, ROG)

The proposed Imperial Solar Energy Center South facility is anticipated to be operational in approximately 10 MW phases. Each phase will be connected to the grid as construction and testing is completed. Completion of the first phase is estimated to occur in September 2012. Primary construction vehicle pollutant emission generators would consist predominately of diesel-powered grading equipment required for remedial grading activities, surface paving and construction of the facility itself and ancillary transmission lines, etc. The analysis methodology utilized in this report is based upon the EPA AP-42 source emissions report for the various classes of diesel construction equipment.[13]

The generation rates of typical equipment are identified in Table 2 on the following page, and would constitute the baseline (unmitigated, or Tier 0) construction emission rates. Estimates of daily load factors (i.e., the amount of time during a day that any piece of equipment is under load) were based upon past ISE engineering experience with similar operations, and consultation with the project applicant.

In cases where the required construction equipment aggregate does not comply with the applicable standards for a pollutant under examination, mitigation is imposed by requiring cleaner Tier 1 through 4 equipment, as required under the Federal Clean Air Act.[14,15] These maximum emission rates are shown as footnotes to Table 2 for CO, NO_x and PM_{10} for Tier 2 or better (denoted as Tier 2+) equipment.[16] Additional recommendations for *"Blue Sky Series"* equipment will be made if the applicant cannot demonstrate strict Tier 2+ compliance.[17]

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[13] This tabulation provided by the EPA is the foundation of all construction emission programs available by CARB, such as *OFFROAD* and the like. This equipment list would be classified as Tier Zero (Tier 0) equipment having none of the emissions control technologies required under the newer Tier 1 through 3 programs. This is the case for older construction equipment that is sometimes used on project sites.

[14] Source: *US Code of Federal Regulations, Title 40, Part 89 [40 CFR Part 89].*

[15] In most cases the federal regulations for diesel construction equipment also apply in California, whose authority to set emission standards for new diesel engines is limited. The federal Clean Air Act Amendments of 1990 (CAA) preempt California's authority to control emissions from both new farm and construction equipment under 175 hp *[CAA Section 209(e)(1)(A)]* and require California to receive authorization from the federal EPA for controls over other off-road sources *[CAA Section 209 (e)(2)(A)]*.

[16] Again, for the purposes of mitigation, any construction equipment unable to comply with the applicable standards for a specific pollutant will be reanalyzed using the applicable Tier 2 equipment for engine sizes over 50 HP. These emission rates became mandatory for all equipment built starting 2001 or later (depending on engine size).

[17] The *"Blue Sky Series"* designation [40 CFR Part 89] is a voluntary program enacted by the USEPA, requiring participating engine manufacturers to produce cleaner burning engines that are at least 40% better than current Tier 2 or 3 mandates. Engines with this designation are assumed by the EPA to produce *de facto compliance* with current and future air quality emissions standards. This program

TABLE 2: Baseline 'Tier 0' AP-42 Equipment Pollutant Generation Rates[18]

	Generation Rates (pounds per horsepower-hour)					
Equipment Class	**CO**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**ROG**
Track Backhoe	0.0150	0.0220	0.0020	0.0010	0.0009	0.0030
Dozer - D8 Cat	0.0150	0.0220	0.0020	0.0010	0.0009	0.0030
Hydraulic Crane	0.0090	0.0230	0.0020	0.0015	0.0014	0.0030
Loader/Grader	0.0150	0.0220	0.0020	0.0010	0.0009	0.0030
Side Boom	0.0130	0.0310	0.0020	0.0015	0.0014	0.0030
Water Truck	0.0060	0.0210	0.0020	0.0015	0.0014	0.0020
Concrete Truck	0.0060	0.0210	0.0020	0.0015	0.0014	0.0020
Concrete Pump	0.0110	0.0180	0.0020	0.0010	0.0009	0.0020
Dump/Haul Trucks	0.0060	0.0210	0.0020	0.0015	0.0014	0.0020
Paver / Blade	0.0070	0.0230	0.0020	0.0010	0.0009	0.0010
Roller / Compactor	0.0070	0.0200	0.0020	0.0010	0.0009	0.0020
Scraper	0.0110	0.0190	0.0020	0.0015	0.0014	0.0010

Emissions Reduction Mandates:

- The maximum CO emissions from Tier 2 equipment is 0.0082 pounds per horsepower-hour (lb/HP-hr) for equipment with power ratings between 50 and 175 HP, and 0.0057 lb/HP-hr for equipment with power ratings over 175 HP. Tier 3 ratings only apply between 50 to 750 HP and are identical to Tier 2 requirements. Tier 4 requirements (to be phased-in between 2008 and 2015) set a sliding scale on CO limits ranging from 0.0132 lb/HP-hr for small engines, to 0.0057 lb/HP-hr for engines up to 750 HP.
- The maximum NO_x and PM_{10} emissions from Tier 2 equipment are 0.0152 and 0.0003 lb/HP-hr regardless of the engine size. Tier 3 emissions must meet the Tier 2 requirement. Tier 4 standards further reduce this level to 0.0006 lb/HP-hr for NO_x, and 0.00003 lb/HP-hr for PM_{10} for engines over 75 HP.

Table data sourced U.S. EPA AP-42 "Compilation of Air Pollutant Emission Factors", 9/85 through present.

Ratings shown for full (100%) load factor.

Finally, fine particulate dust generation ($PM_{2.5}$) from construction equipment was analyzed using the methodology identified in the SCAQMD document entitled, *"Methodology to Calculate Particulate Matter (PM) 2.5 and $PM_{2.5}$ Significance Thresholds"*. This approach, which utilizes the California Emission Inventory Development and Reporting System (CEIDARS) database, estimates $PM_{2.5}$ emissions as a fractional percentage of the aggregate PM_{10} emissions. For diesel construction equipment, the fractional emission factor is 0.920 $PM_{2.5}$ / PM_{10}.

also exists for recreational and commercial marine diesel engines [40 CFR Part 94] and land-based non-road spark-ignition engines over 25 HP [40 CFR Part1048].

[18] The $PM_{2.5}$ emission factors are based upon the SCAQMD document, *"Final – Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds"*, 10/06. The correction factor for diesel equipment of this type is 0.920.

Fugitive Dust Emission Modeling (PM_{10}, $PM_{2.5}$)

Fugitive dust generation from the proposed grading plan was analyzed using the methodology recommended in the SCAQMD CEQA Handbook guidelines for calculating 10-micron Particulate Matter (PM_{10}) due to earthwork movement and stockpiling. The analysis assumed low-wind speeds and active wet suppression control. Aggregate levels of PM_{10}, based upon the best available surface grading estimates, were calculated in pounds per day and compared to the applicable significance criteria shown in Table 1 above for general screening purposes.

For surface grading operations, the fractional emission factor is 0.208 $PM_{2.5}$ / PM_{10} based upon the SCAQMD approach. For unpaved road travel, the fractional emission factor is 0.212 $PM_{2.5}$ / PM_{10}.

Combustion-Fired Health-Risk Emission Modeling (PM_{10}, $PM_{2.5}$)

For the purposes of this analysis, construction vehicle pollutant emission generators would consist entirely of construction activities associated with rough and remedial grading operations (which is the worst-case pollution emission scenario). The analysis methodology utilized in this report is based upon EPA and CARB guidelines for construction operations. Construction emissions were based upon the previously identified EPA Tier 0 through Tier 2+ generation rates for the various classes of diesel construction equipment.

A screening risk assessment of diesel-fired toxics from construction equipment was performed using the *SCREEN3* dispersion model developed by the EPA's Office of Air Quality Planning and Standards.[19] The SCREEN3 model uses a Gaussian plume dispersion algorithm that incorporates source-related and meteorological factors to estimate pollutant concentration from continuous sources.

It is assumed that the pollutant does not undergo any chemical reactions, and that no other removal processes, such as wet or dry deposition, act on the plume during its transport from the source.

Using the concentrations obtained from the screening model, the diesel toxic risk can be defined as shown below:

$$Risk = \frac{F_{\mathrm{wind}} \times EMFAC \times URF_{\mathrm{70\ year\ exposure}}}{Dilution}$$

[19] The methodology is based upon the *Industrial Source Complex (ISC3)* source dispersion approach as outlined in the *EPA-454/B-95-003b* technical document. The SCREEN3 model is used within the State of California and is typically more restrictive than the ISC3 model.

where, *Risk* is the excess cancer risk (probability in one-million);

F_{wind} is the frequency of the wind blowing from the exhaust source to the receptor (the default value is 1.0);

EMFAC is the exhaust particulate emission factor (the level from the screening model);

$URF_{70\ year\ exposure}$ is the Air Resource Board unit risk probability factor (300 x 10^{-6}, or 300 in a million cancer risk per µg/m^3 of diesel combustion generated PM_{10} inhaled in a 70-year lifetime based upon *ARB 1999 Staff Report from the Scientific Review Panel (SRP) on Diesel Toxics*); and,

Dilution is the atmospheric dilution ratio during source-to-receptor transport (the default value of 1.0 assumes no dilution)

Given the above assumptions for wind frequency and atmospheric dilution ratio, and substituting the CARB recommended value for the unit risk probability factor, gives the following expression:

$$Risk = \frac{1 \times EMFAC \times 300x10^{-6}}{1} = 300x10^{-6} \times EMFAC \text{ per person}$$

Thus, the percentage of risk of cancer to any given person, being exposed to a concentration of pollution equal to EMFAC (in µg/m^3) over a continuous period of 70-years, would be:

$$Risk(\%) = (300x10^{-6} \times EMFAC) \times 100 = 300x10^{-4} \times EMFAC \text{ per person}$$

Where it can be directly stated that a risk percentage of, say, 25% would indicate a 25% probability of inhaled cancer risk for the given level of exposure if consumed continuously for a period of 70-years. A 50% probability would correspond to a 50:50 chance of inhaled cancer risk if consumed continuously for a period of 70-years, and so on.

For the construction-related diesel-fired toxics analysis, an area-source consistent in dimensions with the proposed grading area will be assumed. A simplified elevated terrain model (which is consistent with the area surrounding the project site) with no building downwash corrections and a worst-case wind direction was utilized.

Aggregate Construction Vehicle Emission Air Quality Modeling

Motor vehicles emissions associated with construction of the proposed Imperial Solar Energy Center South site were calculated by multiplying the appropriate emission factor (in grams per mile) times the estimated average trip length and the total number of vehicles. Appropriate conversion factors were then applied to provide aggregate emission units of pounds per day.

CARB estimates on-road motor vehicle emissions by using a series of models called the *Motor Vehicle Emission Inventory* (MVEI) Models. Four computer models, which form the MVEI, are *CALIMFAC, WEIGHT, EMFAC*, and *BURDEN*. [20,21]

For the current analysis, the *EMFAC 2007 Model v2.3* of the MVEI[22] was run using input conditions specific to the Salton Sea air basin to predict operational vehicle emissions from the project based upon a project completion scenario year of 2012. A mix ratio consistent with the Caltrans ITS Transportation Project-Level Carbon Monoxide Protocol was used. This consisted of the following air standard Otto-Cycle engine vehicle distribution percentages:

Light Duty Autos = 69.0	Light Duty Trucks = 19.4	Medium Duty Trucks = 6.4
Heavy Duty Trucks = 4.7	Buses = 0.0	Motorcycles = 0.5

The aggregate emission factors from the CARB *EMFAC 2007* model are provided as an attachment at the end of this report.

Finally, fine particulate dust generation ($PM_{2.5}$) from motor vehicle operation was analyzed using the methodology identified by SCAQMD[23]. This approach, which utilizes the *California Emission Inventory Development and Reporting System* (CEIDARS) database, estimates $PM_{2.5}$ emissions as a fractional percentage of the aggregate PM_{10} emissions. For operational vehicular traffic, the fractional emission factor is 0.998 $PM_{2.5}$ / PM_{10} based upon the SCAQMD approach.

[20] The CALIMFAC model produces base emission rates for each model year when a vehicle is new, and as it accumulates mileage, and the emission controls deteriorate. The WEIGHT model calculates the relative weighting each model year should be given in the total inventory, and each model year's accumulated mileage. The EMFAC model uses this information, along with the correction factors and other data, to produce fleet composite emission factors. Finally, the BURDEN model combines the emission factors with county-specific activity data to produce to emission inventories.

[21] The module named *EMFAC* should not be confused with the entire EMFAC 2007 program itself (which calls the subroutines *CALIMFAC, WEIGHT, EMFAC, and BURDEN* to determine the final emission inventory for a particular area).

[22] This is the most current CARB emissions model approved for use within the State of California.

[23] This is detailed in the document entitled, *"Final Methodology to Calculate Particulate Matter (PM) 2.5 and $PM_{2.5}$ Significance Thresholds"*, published by SCAQMD.

FINDINGS

Existing Climate Conditions

The climate within the region surrounding the proposed Imperial Solar Energy Center South site is characterized by hot, dry summers and mild, wet winters; it is dominated by a semi-permanent high-pressure cell located over the Gulf of Baja and Mohave Desert. This high-pressure cell maintains clear skies over the air basin for much of the year. It also drives the dominant onshore circulation, as can be seen in Figure 7 on the following page, and helps to create two types of temperature inversions, subsidence and radiation, that contribute to local air quality degradation.

Subsidence inversions occur during the warmer months, as descending air associated with the high-pressure cell meets cool marine air and traps pollutants below it. Radiation inversion typically develops on winter nights, when air near the ground cools by thermal radiation, and the air aloft remains warm trapping pollutants. Frequently, the strongest winds in the basin occur during the night and morning hours due to the absence of onshore sea breezes. The overall result is a noticeable degradation in local air quality.

Occasionally during the months of October through February, offshore flow becomes a dominant factor in the regional air quality. These periods, known as “Santa Ana Conditions”, are typically maximal during the month of December with wind speeds from the north to east approaching 35 knots and gusting to over 50 knots. This air movement is caused by clockwise pressure circulation over the Great Basin (i.e., the high plateau east of the Sierra Mountains and west of the Rocky Mountains including most of Nevada and Utah), which results in significant downward air motion towards the ocean. Stronger Santa Ana winds can have gusts greater than 60 knots over widespread areas and gusts greater than 100 knots in canyon areas.

Finally, in the area of the proposed project site, the minimum and maximum average temperatures are 40º F and 110º F, respectively.[24] Precipitation in the area averages 2.9 inches annually, 90 percent of which falls between November and April. The prevailing wind direction is from the west-northwest, with an annual mean speed of 4 to 12 miles per hour. Sunshine is usually plentiful in the proposed project area but night and morning cloudiness is common during the spring and summer.

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[24] Source: *National Weather Service (NWS) / National Oceanographic and Atmospheric Administration (NOAA), 2010.*

FIGURE 7: Project Air Basin Aerial Map (ISE 8/10)

Existing Air Quality Levels

<u>CARB Aerometric Station Data within Project Vicinity</u>

Tables 3a through -m, starting below, provide a summary of the highest pollutant levels recorded at the previously identified monitoring station for the last year available (2009), based upon the latest data from the CARB Aerometric Data Analysis and Management (ADAM) System database.

TABLE 3a: Calexico Monitoring Station – Maximum Hourly O_3 Levels

Air Resources Board

iADAM

Highest 4 Daily Maximum Hourly Ozone Measurements

Calexico-Ethel Street

FAQs

Year:	2007		2008		2009	
	Date	Measurement	Date	Measurement	Date	Measurement
First High:	Jun 15	0.112	Oct 29	0.128	May 8	0.104
Second High:	Jun 3	0.104	Sep 13	0.121	May 27	0.101
Third High:	Jul 4	0.104	Jul 31	0.114	Oct 24	0.100
Fourth High:	Aug 31	0.101	Jul 17	0.110	Jul 27	0.097
# Days Above State Standard:		10		8		5
California Designation Value:		0.11		0.11		0.11
Expected Peak Day Conc.:		0.112		0.112		0.114
# Days Above Nat'l Standard:		*0*		*1*		*0*
National Design Value:		*0.111*		*0.112*		*0.112*
Year Coverage:		96		100		96

Go Backward One Year | New Top 4 Summary | Go Forward One Year

Notes: All concentrations are expressed in parts per million.
The national 1-hour ozone standard was revoked in June 2005 and is no longer in effect. Statistics related to the revoked standard are shown in *italics* or *italics*.
State exceedances are shown in yellow. Exceedances of the revoked national 1-hour standard are shown in *orange*.
An exceedance is not necessarily a violation.
Year Coverage indicates the extent to which available monitoring data represent the time of the year when concentrations are expected to be highest. 0 means that data represent none of the high period; 100 means that data represent the entire high period. A high Year Coverage does not mean that there was sufficient data for annual statistics to be considered valid.
* There was insufficient (or no) data available to determine the value.

Source: CARB ADAM Ambient Air Quality Inventory – 8/10

TABLE 3b: Calexico Monitoring Station – Maximum Eight-Hour O_3 Levels

Air Resources Board

iADAM

Highest 4 Daily Maximum 8-Hour Ozone Averages

Calexico-Ethel Street

FAQs

Year:	2007		2008		2009	
	Date	8-Hr Average	Date	8-Hr Average	Date	8-Hr Average
National:						
First High:	Jun 15	0.094	Oct 29	0.093	May 8	0.083
Second High:	Jul 4	0.094	Jun 14	0.088	May 25	0.080
Third High:	Jun 3	0.088	Jul 31	0.088	May 6	0.077
Fourth High:	May 9	0.087	Jul 17	0.087	Jun 23	0.076
California:						
First High:	Jun 15	0.095	Oct 29	0.094	May 8	0.083
Second High:	Jul 4	0.095	Jun 14	0.088	May 25	0.081
Third High:	Jun 3	0.089	Jul 17	0.088	May 6	0.077
Fourth High:	May 9	0.087	Jul 31	0.088	Jun 23	0.077
National:						
# Days Above '08 Nat'l Std.:	9		7		4	
'08 Nat'l Std. Design Value:	0.079		0.080		0.083	
National Year Coverage:	96		100		96	
California:						
# Days Above State Standard:	20		17		9	
California Designation Value:	0.093		0.089		0.089	
Expected Peak Day Conc.:	0.093		0.092		0.092	
California Year Coverage:	95		100		95	

Go Backward One Year | New Top 4 Summary | Go Forward One Year

Notes: All averages are expressed in parts per million.
National exceedances are shown in orange. State exceedances are shown in yellow.
An exceedance is not necessarily a violation.
Year Coverage indicates the extent to which available monitoring data represent the time of the year when concentrations are expected to be highest. 0 means that data represent none of the high period; 100 means that data represent the entire high period. A high Year Coverage does not mean that there was sufficient data for annual statistics to be considered valid.
* There was insufficient (or no) data available to determine the value.

Source: CARB ADAM Ambient Air Quality Inventory – 8/10

TABLE 3c: Calexico Monitoring Station – Maximum 24-Hour $PM_{2.5}$ Levels

Air Resources Board

iADAM

Highest 4 Daily 24-Hour PM2.5 Averages

Calexico-Ethel Street

FAQs

Year:	2007		2008		2009	
	Date	24-Hr Average	Date	24-Hr Average	Date	24-Hr Average
National:						
First High:	Dec 17	66.7	Jan 4	37.1	Dec 12	45.0
Second High:	Dec 5	52.7	Jan 10	24.0	Dec 21	39.9
Third High:	Nov 20	38.5	Jan 19	20.9	Sep 4	39.7
Fourth High:	Jan 3	31.9	Nov 5	20.2	Dec 24	38.1
California:						
First High:	Dec 17	87.9	Dec 25	93.6	Dec 5	75.3
Second High:	Dec 5	68.6	Oct 29	52.8	Jan 2	48.3
Third High:	Dec 18	60.4	Dec 22	48.5	Jan 7	48.2
Fourth High:	Feb 9	52.3	Jan 4	48.2	Dec 12	48.0
Estimated Days > Nat'l 24-Hr Std:		9.2		*		*
Measured Days > Nat'l 24-Hr Std:		3		1		4
Nat'l 24-Hr Std Design Value:		42		36		34
Nat'l 24-Hr Std 98th Percentile:		38.5		24.0		39.9
National Annual Std Design Value:		*		*		*
National Annual Average:		12.9		*		*
State Ann'l Std Designation Value:		23		23		23
State Annual Average:		23.2		*		18.7
Year Coverage:		98		50		53

Go Backward One Year | New Top 4 Summary | Go Forward One Year

Notes: All concentrations are expressed in micrograms per cubic meter.
National exceedances are shown in orange. State exceedances are shown in yellow.
An exceedance is not necessarily a violation.
State and national statistics may differ for the following reasons:
State statistics are based on California approved samplers, whereas national statistics are based on samplers using federal reference or equivalent methods.
State and national statistics may therefore be based on different samplers.
State criteria for ensuring that data are sufficiently complete for calculating valid annual averages are more stringent than the national criteria.
Year Coverage indicates the extent to which available monitoring data represent the time of the year when concentrations are expected to be highest. 0 means that data represent none of the high period; 100 means that data represent the entire high period. A high Year Coverage does not mean that there was sufficient data for annual statistics to be considered valid.
* There was insufficient (or no) data available to determine the value.

Source: CARB ADAM Ambient Air Quality Inventory – 8/10

TABLE 3d: Calexico Monitoring Station – Maximum 24-Hour PM_{10} Levels

Air Resources Board

iADAM

Highest 4 Daily 24-Hour PM10 Averages
Calexico-Ethel Street

FAQs

Year:	2007		2008		2009	
	Date	24-Hr Average	Date	24-Hr Average	Date	24-Hr Average
National:						
First High:	Jun 5	282.0	May 12	110.5	Sep 4	275.9
Second High:	Oct 21	142.0	Apr 30	103.9	Jan 1	186.4
Third High:	Mar 13	127.0	Dec 4	99.2	Jul 18	155.0
Fourth High:	Apr 12	124.0	Mar 13	87.7	May 19	126.7
California:						
First High:	Jun 5	282.0	May 12	109.7	Sep 4	265.8
Second High:	Oct 21	144.0	Apr 30	103.1	Jan 1	193.4
Third High:	Mar 13	127.0	Dec 4	99.5	Jul 18	147.9
Fourth High:	Apr 12	126.0	Mar 13	87.9	May 19	122.4
Measured:						
# Days Above Nat'l Standard:		1		0		3
# Days Above State Standard:		36		31		34
Estimated:						
3-Yr Avg # Days Above Nat'l Std:		6.0		4.0		8.0
# Days Above Nat'l Standard:		6.1		0.0		18.3
# Days Above State Standard:		219.1		186.8		207.4
State 3-Yr Maximum Average:		66		66		66
State Annual Average:		65.5		53.9		65.4
National 3-Year Average:		*58*		*59*		*
National Annual Average:		*65.6*		*54.1*		*
Year Coverage:		100		100		98

Go Backward One Year | New Top 4 Summary | Go Forward One Year

Notes: All concentrations are expressed in micrograms per cubic meter.
The national annual average PM10 standard was revoked in December 2006 and is no longer in effect.
Statistics related to the revoked standard are shown in *italics* or *italics*.
National exceedances are shown in orange. State exceedances are shown in yellow.
An exceedance is not necessarily a violation.
Statistics may include data that are related to an exceptional event.
State and national statistics may differ for the following reasons:
State statistics are based on California approved samplers, whereas national statistics are based on samplers using federal reference or equivalent methods.
State and national statistics may therefore be based on different samplers.
State statistics for 1998 and later are based on *local* conditions (except for sites in the South Coast Air Basin, where State statistics for 2002 and later are based on *local* conditions).
National statistics are based on *standard* conditions.
State criteria for ensuring that data are sufficiently complete for calculating valid annual averages are more stringent than the national criteria.
Measurements are usually collected every six days. Measured days counts the days that a measurement was greater than the level of the standard; Estimated days mathematically estimates how many days concentrations would have been greater than the level of the standard had each day been monitored.
3-Year statistics represent the listed year and the 2 years before the listed year.
Year Coverage indicates the extent to which available monitoring data represent the time of the year when concentrations are expected to be highest. 0 means that data represent none of the high period; 100 means that data represent the entire high period. A high Year Coverage does not mean that there was sufficient data for annual statistics to be considered valid.
* There was insufficient (or no) data available to determine the value.

Source: CARB ADAM Ambient Air Quality Inventory – 8/10

TABLE 3e: Calexico Monitoring Station – Maximum Eight-Hour CO Levels

Air Resources Board
iADAM

Highest 4 Daily Maximum 8-Hour Carbon Monoxide Averages
Calexico-Ethel Street
FAQs

Year:	2007		2008		2009	
	Date	8-Hr Average	Date	8-Hr Average	Date	8-Hr Average
National:						
First High:	Dec 5	7.53	Dec 22	6.34	Dec 5	7.46
Second High:	Dec 17	6.41	Nov 22	5.45	Dec 5	5.54
Third High:	Dec 5	6.41	Feb 19	5.31	Dec 25	5.31
Fourth High:	Jan 4	5.55	Oct 29	4.83	Oct 27	5.13
California:						
First High:	Dec 5	7.53	Dec 22	6.34	Dec 5	7.46
Second High:	Dec 17	6.41	Nov 21	5.45	Dec 25	5.31
Third High:	Dec 4	5.63	Feb 19	5.31	Oct 26	5.13
Fourth High:	Jan 3	5.55	Oct 29	4.83	Nov 20	4.87
# Days Above Nat'l Standard:		0		0		0
# Days Above State Standard:		0		0		0
Year Coverage:		97		90		97

Go Backward One Year | New Top 4 Summary | Go Forward One Year

Notes: All averages are expressed in parts per million.
National exceedances are shown in orange. State exceedances are shown in yellow.
An exceedance is not necessarily a violation.
Year Coverage indicates the extent to which available monitoring data represent the time of the year when concentrations are expected to be highest. 0 means that data represent none of the high period; 100 means that data represent the entire high period. A high Year Coverage does not mean that there was sufficient data for annual statistics to be considered valid.
* There was insufficient (or no) data available to determine the value.

Source: CARB ADAM Ambient Air Quality Inventory – 8/10

TABLE 3f: Calexico Monitoring Station – Maximum Hourly NO_2 Levels

Air Resources Board
iADAM

Highest 4 Daily Maximum Hourly Nitrogen Dioxide Measurements
Calexico-Ethel Street
FAQs

Year:	2007		2008		2009	
	Date	Measurement	Date	Measurement	Date	Measurement
First High:	Dec 17	0.107	Dec 2	0.146	Jan 1	0.102
Second High:	Dec 5	0.096	Oct 25	0.114	Nov 20	0.092
Third High:	Mar 13	0.081	Feb 19	0.103	Jan 8	0.090
Fourth High:	Oct 9	0.074	Mar 8	0.098	Apr 7	0.086
# Days Above State Standard:		0		0		0
Annual Average:		0.014		0.014		0.014
Year Coverage:		99		98		99

Go Backward One Year | New Top 4 Summary | Go Forward One Year

Notes: All averages are expressed in parts per million.
National exceedances are shown in orange. State exceedances are shown in yellow.
An exceedance is not necessarily a violation.
Year Coverage indicates the extent to which available monitoring data represent the time of the year when concentrations are expected to be highest. 0 means that data represent none of the high period; 100 means that data represent the entire high period. A high Year Coverage does not mean that there was sufficient data for annual statistics to be considered valid.
* There was insufficient (or no) data available to determine the value.

Source: CARB ADAM Ambient Air Quality Inventory – 8/10

TABLE 3g: Calexico Monitoring Station – Maximum 24-Hour SO_2 Levels

Air Resources Board

iADAM

Highest 4 Daily Maximum State 24-Hour Sulfur Dioxide Averages
Calexico-Ethel Street

FAQs

Year:	2007		2008		2009	
	Date	24-Hr Average	Date	24-Hr Average	Date	24-Hr Average
First High:	Jan 10	0.004	Feb 19	0.007	Feb 5	0.004
Second High:	Jan 3	0.004	Apr 29	0.003	Jan 7	0.004
Third High:	Mar 14	0.003	Mar 8	0.003	Jan 22	0.003
Fourth High:	Jul 2	0.003	Mar 19	0.003	Jan 2	0.003
Annual Average:		0.000		0.000		0.000
Year Coverage:		98		99		98

Go Backward One Year | New Top 4 Summary | Go Forward One Year

Notes: All averages are expressed in parts per million.
State exceedances are shown in yellow.
An exceedance is not necessarily a violation.
Year Coverage indicates the extent to which available monitoring data represent the time of the year when concentrations are expected to be highest. 0 means that data represent none of the high period; 100 means that data represent the entire high period. A high Year Coverage does not mean that there was sufficient data for annual statistics to be considered valid.
* There was insufficient (or no) data available to determine the value.

Source: CARB ADAM Ambient Air Quality Inventory – 8/10

TABLE 3h: El Centro Monitoring Station – Maximum Hourly O_3 Levels

Air Resources Board

iADAM

Highest 4 Daily Maximum Hourly Ozone Measurements
El Centro-9th Street

FAQs

Year:	2007		2008		2009	
	Date	Measurement	Date	Measurement	Date	Measurement
First High:	Jun 26	0.118	Oct 29	0.135	Oct 21	0.111
Second High:	Jul 5	0.114	Sep 13	0.116	Oct 24	0.105
Third High:	May 9	0.105	Jun 14	0.114	May 8	0.100
Fourth High:	Jun 3	0.104	Jul 17	0.102	Sep 23	0.100
# Days Above State Standard:		8		4		9
California Designation Value:		0.12		0.12		0.11
Expected Peak Day Conc.:		0.119		0.121		0.111
# Days Above Nat'l Standard:		*0*		*1*		*0*
National Design Value:		*0.118*		*0.118*		*0.114*
Year Coverage:		100		100		98

Go Backward One Year | New Top 4 Summary | Go Forward One Year

Notes: All concentrations are expressed in parts per million.
The national 1-hour ozone standard was revoked in June 2005 and is no longer in effect. Statistics related to the revoked standard are shown in *italics* or *italics*.
State exceedances are shown in yellow. Exceedances of the revoked national 1-hour standard are shown in orange.
An exceedance is not necessarily a violation.
Year Coverage indicates the extent to which available monitoring data represent the time of the year when concentrations are expected to be highest. 0 means that data represent none of the high period; 100 means that data represent the entire high period. A high Year Coverage does not mean that there was sufficient data for annual statistics to be considered valid.
* There was insufficient (or no) data available to determine the value.

Source: CARB ADAM Ambient Air Quality Inventory – 8/10

TABLE 3i: El Centro Monitoring Station – Maximum Eight-Hour O_3 Levels

Air Resources Board iADAM

Highest 4 Daily Maximum 8-Hour Ozone Averages
El Centro-9th Street FAQs

Year:	2007		2008		2009	
	Date	8-Hr Average	Date	8-Hr Average	Date	8-Hr Average
National:						
First High:	Jun 28	0.094	Jul 17	0.084	Jul 16	0.085
Second High:	Jul 4	0.088	Jun 14	0.079	Aug 14	0.084
Third High:	May 9	0.086	Oct 29	0.075	Aug 9	0.082
Fourth High:	Jun 26	0.083	Jul 18	0.074	Jun 27	0.081
California:						
First High:	Jun 28	0.094	Jul 17	0.085	Jul 16	0.086
Second High:	Jul 4	0.089	Jun 14	0.079	Aug 14	0.084
Third High:	May 9	0.087	Oct 29	0.075	Jun 27	0.082
Fourth High:	Jun 26	0.084	Jul 18	0.074	Aug 9	0.082
National:						
# Days Above '08 Nat'l Std.:		8		2		11
'08 Nat'l Std. Design Value:		0.086		0.082		0.079
National Year Coverage:		100		100		97
California:						
# Days Above State Standard:		23		9		30
California Designation Value:		0.097		0.095		0.089
Expected Peak Day Conc.:		0.100		0.099		0.089
California Year Coverage:		100		100		97

Go Backward One Year | New Top 4 Summary | Go Forward One Year

Notes: All averages are expressed in parts per million.
National exceedances are shown in orange. State exceedances are shown in yellow.
An exceedance is not necessarily a violation.
Year Coverage indicates the extent to which available monitoring data represent the time of the year when concentrations are expected to be highest. 0 means that data represent none of the high period; 100 means that data represent the entire high period. A high Year Coverage does not mean that there was sufficient data for annual statistics to be considered valid.
* There was insufficient (or no) data available to determine the value.

Source: CARB ADAM Ambient Air Quality Inventory – 8/10

TABLE 3j: El Centro Monitoring Station – Maximum 24-Hour $PM_{2.5}$ Levels

Air Resources Board

iADAM

Highest 4 Daily 24-Hour PM2.5 Averages
El Centro-9th Street

FAQs

Year:	2007		2008		2009	
	Date	24-Hr Average	Date	24-Hr Average	Date	24-Hr Average
National:						
First High:	Nov 20	30.5	Jan 4	26.7	Dec 12	37.7
Second High:	Dec 5	20.9	Jul 17	17.8	Jan 7	21.8
Third High:	Dec 29	18.2	Jul 2	17.0	Jul 18	17.9
Fourth High:	Nov 8	17.4	Apr 21	16.2	Sep 4	17.9
California:						
First High:	Nov 20	30.5	Jan 4	26.7	Dec 12	37.7
Second High:	Dec 5	20.9	Jul 17	17.8	Jan 7	21.8
Third High:	Dec 29	18.2	Jul 2	17.0	Jul 18	17.9
Fourth High:	Nov 8	17.4	Apr 21	16.2	Sep 4	17.9
Estimated Days > Nat'l 24-Hr Std:		0.0		*		3.1
Measured Days > Nat'l 24-Hr Std:		0		0		1
Nat'l 24-Hr Std Design Value:		22		*		*
Nat'l 24-Hr Std 98th Percentile:		18.2		*		17.9
National Annual Std Design Value:		8.9		*		*
National Annual Average:		8.4		*		7.9
State Ann'l Std Designation Value:		*		*		8
State Annual Average:		*		*		8.0
Year Coverage:		88		83		98

Go Backward One Year | New Top 4 Summary | Go Forward One Year

Notes: All concentrations are expressed in micrograms per cubic meter.
National exceedances are shown in orange. State exceedances are shown in yellow.
An exceedance is not necessarily a violation.
State and national statistics may differ for the following reasons:
State statistics are based on California approved samplers, whereas national statistics are based on samplers using federal reference or equivalent methods.
State and national statistics may therefore be based on different samplers.
State criteria for ensuring that data are sufficiently complete for calculating valid annual averages are more stringent than the national criteria.
Year Coverage indicates the extent to which available monitoring data represent the time of the year when concentrations are expected to be highest. 0 means that data represent none of the high period; 100 means that data represent the entire high period. A high Year Coverage does not mean that there was sufficient data for annual statistics to be considered valid.
* There was insufficient (or no) data available to determine the value.

Source: CARB ADAM Ambient Air Quality Inventory – 8/10

TABLE 3k: El Centro Monitoring Station – Maximum 24-Hour PM_{10} Levels

Air Resources Board

iADAM

Highest 4 Daily 24-Hour PM10 Averages

El Centro-9th Street

FAQs

Year:	2007		2008		2009	
	Date	24-Hr Average	Date	24-Hr Average	Date	24-Hr Average
National:						
First High:	Jun 5	200.0	Apr 30	88.2	Sep 4	243.1
Second High:	Apr 12	121.0	Jul 5	59.2	Jul 18	161.1
Third High:	Sep 19	117.0	Nov 20	53.9	Nov 27	135.9
Fourth High:	Nov 20	98.0	Mar 1	52.6	Apr 7	134.0
California:						
First High:	Jun 5	196.0	Apr 30	88.7	Sep 4	233.7
Second High:	Apr 12	127.0	Jul 5	57.2	Jul 18	152.9
Third High:	Sep 19	116.0	Nov 20	54.7	Nov 27	140.0
Fourth High:	Nov 20	99.0	Mar 1	53.9	Apr 7	135.3
Measured:						
# Days Above Nat'l Standard:		1		0		2
# Days Above State Standard:		22		4		17
Estimated:						
3-Yr Avg # Days Above Nat'l Std:		2.0		2.0		7.0
# Days Above Nat'l Standard:		7.0		0.0		13.1
# Days Above State Standard:		*		25.5		104.6
State 3-Yr Maximum Average:		43		43		48
State Annual Average:		*		32.7		47.9
National 3-Year Average:		*43*		*42*		*
National Annual Average:		*50.1*		*32.9*		*
Year Coverage:		89		91		98

Go Backward One Year | New Top 4 Summary | Go Forward One Year

Notes: All concentrations are expressed in micrograms per cubic meter.
The national annual average PM10 standard was revoked in December 2006 and is no longer in effect. Statistics related to the revoked standard are shown in *italics* or *italics*.
National exceedances are shown in orange. State exceedances are shown in yellow.
An exceedance is not necessarily a violation.
Statistics may include data that are related to an exceptional event.
State and national statistics may differ for the following reasons:
State statistics are based on California approved samplers, whereas national statistics are based on samplers using federal reference or equivalent methods. State and national statistics may therefore be based on different samplers.
State statistics for 1998 and later are based on *local* conditions (except for sites in the South Coast Air Basin, where State statistics for 2002 and later are based on *local* conditions). National statistics are based on *standard* conditions.
State criteria for ensuring that data are sufficiently complete for calculating valid annual averages are more stringent than the national criteria.
Measurements are usually collected every six days. Measured days counts the days that a measurement was greater than the level of the standard; Estimated days mathematically estimates how many days concentrations would have been greater than the level of the standard had each day been monitored.
3-Year statistics represent the listed year and the 2 years before the listed year.
Year Coverage indicates the extent to which available monitoring data represent the time of the year when concentrations are expected to be highest. 0 means that data represent none of the high period; 100 means that data represent the entire high period. A high Year Coverage does not mean that there was sufficient data for annual statistics to be considered valid.
* There was insufficient (or no) data available to determine the value.

Source: CARB ADAM Ambient Air Quality Inventory – 8/10

TABLE 3l: El Centro Monitoring Station – Maximum Eight-Hour CO Levels

Air Resources Board — iADAM

Highest 4 Daily Maximum 8-Hour Carbon Monoxide Averages
El Centro-9th Street
FAQs

Year:	2007		2008		2009	
	Date	8-Hr Average	Date	8-Hr Average	Date	8-Hr Average
National:						
First High:	Oct 26	1.67	Feb 17	1.71	Dec 10	3.20
Second High:	Jan 4	1.58	Mar 5	1.66	Dec 10	2.63
Third High:	Dec 16	1.58	Feb 6	1.59	Dec 9	2.59
Fourth High:	Dec 15	1.54	Feb 8	1.58	Dec 9	2.57
California:						
First High:	Oct 26	1.67	Feb 17	1.71	Dec 10	3.20
Second High:	Jan 3	1.58	Mar 5	1.66	Dec 9	2.59
Third High:	Dec 16	1.58	Feb 6	1.59	Dec 8	2.55
Fourth High:	Dec 14	1.54	Feb 7	1.58	Jun 5	1.79
# Days Above Nat'l Standard:		0		0		0
# Days Above State Standard:		0		0		0
Year Coverage:		98		98		92

Go Backward One Year | New Top 4 Summary | Go Forward One Year

Notes: All averages are expressed in parts per million.
National exceedances are shown in orange. State exceedances are shown in yellow.
An exceedance is not necessarily a violation.
Year Coverage indicates the extent to which available monitoring data represent the time of the year when concentrations are expected to be highest. 0 means that data represent none of the high period; 100 means that data represent the entire high period. A high Year Coverage does not mean that there was sufficient data for annual statistics to be considered valid.
* There was insufficient (or no) data available to determine the value.

Source: CARB ADAM Ambient Air Quality Inventory – 8/10

TABLE 3m: El Centro Monitoring Station – Maximum Hourly NO_2 Levels

Air Resources Board — iADAM

Highest 4 Daily Maximum Hourly Nitrogen Dioxide Measurements
El Centro-9th Street
FAQs

Year:	2007		2008		2009	
	Date	Measurement	Date	Measurement	Date	Measurement
First High:	Nov 27	0.071	Oct 29	0.081	Nov 23	0.122
Second High:	Feb 10	0.063	Oct 30	0.059	Feb 4	0.051
Third High:	Oct 9	0.062	Nov 20	0.055	Nov 18	0.051
Fourth High:	Mar 6	0.061	Nov 22	0.053	Nov 5	0.051
# Days Above State Standard:		0		0		0
Annual Average:		0.011		0.009		0.008
Year Coverage:		98		98		99

Go Backward One Year | New Top 4 Summary | Go Forward One Year

Notes: All averages are expressed in parts per million.
National exceedances are shown in orange. State exceedances are shown in yellow.
An exceedance is not necessarily a violation.
Year Coverage indicates the extent to which available monitoring data represent the time of the year when concentrations are expected to be highest. 0 means that data represent none of the high period; 100 means that data represent the entire high period. A high Year Coverage does not mean that there was sufficient data for annual statistics to be considered valid.
* There was insufficient (or no) data available to determine the value.

Source: CARB ADAM Ambient Air Quality Inventory – 8/10

The project site is located in the south central portion of the Salton Sea Air Basin. The Basin continues to have a transitional-attainment status of federal standards for Ozone (O_3) and PM_{10}. The Basin is either in attainment or unclassified for federal standards of CO, SO_2, NO_2, and lead. Factors affecting ground level pollutant concentrations include the rate at which pollutants are emitted to the atmosphere, the height from which they are released, and topographic and meteorological features.

Given these factors, the closest monitoring station reported exceedances for O_3, and PM_{10}. All other criteria pollutants were within both federal and state standards, or not monitored.[25]

Onsite Air Pollutant Concentration Findings

The atomic mass distribution of the onsite ambient air-monitoring samples is shown in Figures 8a and -b starting below.[26] Spectral deconvolution of the pattern shown indicated ambient air pollution concentrations, by mass percentage, as shown in Table 4 on the following page.

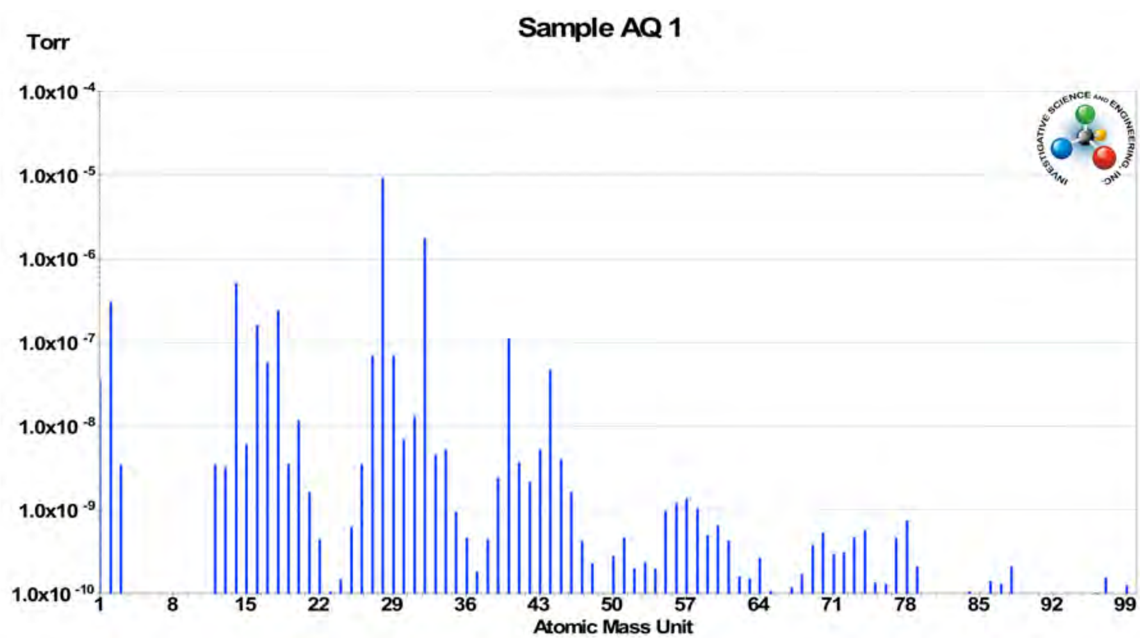

FIGURE 8a: Spectral Content of Ambient Air Monitoring Location AQ 1 (ISE 8/10)

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[25] Monitoring for lead was discontinued entirely in 1998.

[26] The plot in this figure indicates the partial atmospheric pressure (in Torr) as a function of the atomic mass unit. The larger the vertical bar, the greater the concentration of a particular atom (or diatomic form). The unit of Torr is a very small pressure unit - one atmosphere equals 760 Torr.

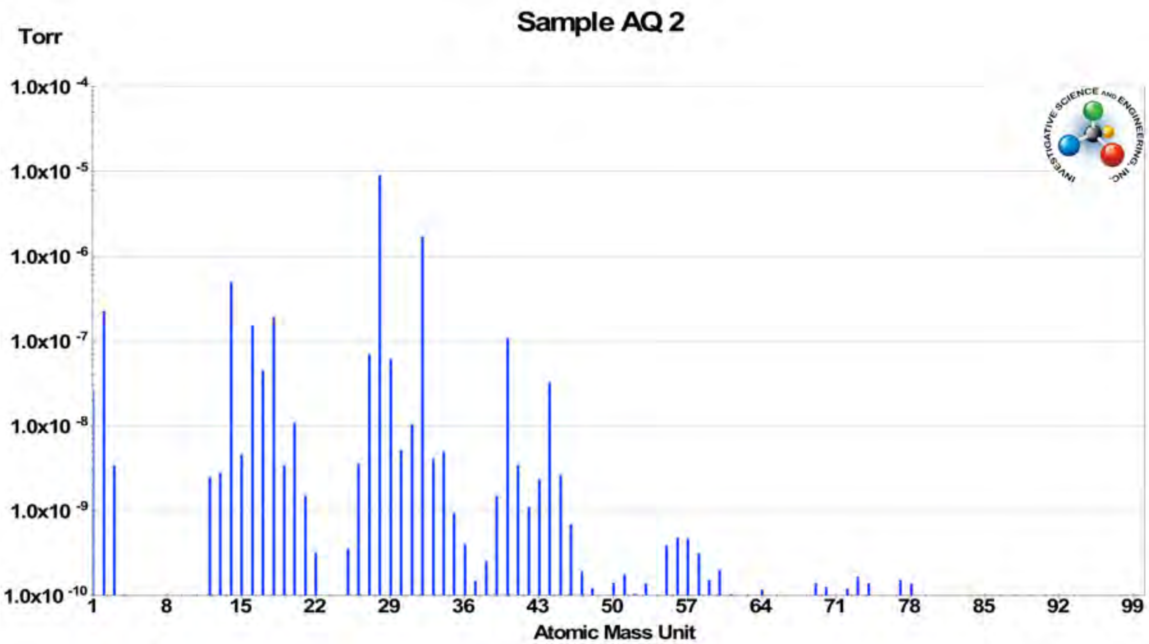

FIGURE 8b: Spectral Content of Ambient Air Monitoring Location AQ 2 (ISE 8/10)

TABLE 4: Ambient Air Quality Monitoring Results

Chemical Compound Examined	Air Sample Composition (% by wt.)	
	AQ 1	AQ 2
Benzene (C_6H_6)	0.0	0.0
Carbon Dioxide (CO_2)	11.8	12.5
Carbon Monoxide (CO)	0.0	0.0
Hydrogen Sulfide (H_2S)	0.0	0.0
Free Hydrogen (H_2)	2.0	1.5
Nitric Oxide (NO)	4.2	4.4
Nitrogen Dioxide (NO_2)	0.0	0.0
Nitrous Oxide (N_2O)	0.0	0.0
Free Nitrogen (N_2)	68.0	68.3
Free Oxygen (O_2)	12.1	11.8
Sulfur Dioxide (SO_2)	0.0	0.0
Water Vapor (H_2O)	1.9	1.6

Data Margin ± 0.1 percent.

Given these findings, no significant ambient air quality impacts are indicated. No respirable 10- and 2.5-micron particulate matter (PM_{10} and $PM_{2.5}$) was indicated in the sample. Toxicity screening against the NIST spectral database indicated no unusual compounds present.

Project Construction Emission Findings

The proposed Imperial Solar Energy Center South site would be incrementally constructed over the course of approximately 17 months. Given this, the following construction findings were indicated.

Construction Vehicle Emissions (CO, NO_x, SO_x, PM_{10}, $PM_{2.5}$, ROG)

The estimated Tier 0 diesel exhaust emissions are provided in Table 5a below for the site clearing and remedial grading, inclusive of any onsite-powered haulage. Based upon the findings, significant NO_x impacts are expected due to construction grading operations and would require Tier 2+ engine technology operating under the *Blue Sky* manufacturer certification program. The mitigated solution is presented in Table 5b.

TABLE 5a: Predicted Construction Emissions – Grading / Clearing / Hauling (Unmitigated Tier 0)

					Aggregate Emissions in Pounds / Day					
Equipment Type	**Qty. Used**	**HP**	**Daily Load Factor (%)**	**Duty Cycle (Hrs. / day)**	**CO**	**NOx**	**SOx**	**PM_{10}**	**$PM_{2.5}$**	**ROG**
Dozer - D8 Cat	1	300	50	8	10.8	27.6	2.4	1.8	1.7	3.6
Loader	1	150	50	8	9.0	13.2	1.2	0.6	0.6	1.8
Water Truck	2	200	50	4	4.8	16.8	1.6	1.2	1.1	1.6
Dump/Haul Trucks	4	300	20	4	5.8	20.2	1.9	1.4	1.3	1.9
Scraper	1	450	75	4	14.9	25.7	2.7	2.0	1.8	1.4
Total for this Construction Task (Σ):					**45.3**	**103.5**	**9.8**	**7.0**	**6.5**	**10.3**
Significance Threshold (ICAPCD):					**550**	**55**	**150**	**150**	**55**	**55**

TABLE 5b: Predicted Construction Emissions – Grading / Clearing / Hauling (Mitigated Tier 2+)

					Aggregate Emissions in Pounds / Day					
Equipment Type	**Qty. Used**	**HP**	**Daily Load Factor (%)**	**Duty Cycle (Hrs. / day)**	**CO**	**NOx**	**SOx**	**PM_{10}**	**$PM_{2.5}$**	**ROG**
Dozer - D8 Cat	1	300	50	8	6.8	7.9	2.4	0.2	0.2	3.6
Loader	1	150	50	8	4.9	4.0	1.2	0.2	0.2	1.8
Water Truck	2	200	50	4	4.6	5.3	1.6	0.2	0.2	1.6
Dump/Haul Trucks	4	300	20	4	5.5	6.3	1.9	0.2	0.2	1.9
Scraper	1	450	75	4	7.7	8.9	2.7	0.3	0.3	1.4
Total for this Construction Task (Σ):					**29.5**	**32.4**	**9.8**	**1.1**	**1.1**	**10.3**
Significance Threshold (ICAPCD):					**550**	**55**	**150**	**150**	**55**	**55**

Additionally, Table 5c below identifies the anticipated emissions due to underground utility construction and PV system construction (or alternatively transmission line construction since equipment utilization would be nearly identical). As can be seen, no significant impact is expected from these smaller operations using standard Tier 2+ equipment. *Blue Sky* engines are not required for these operations.

TABLE 5c: Predicted Construction Emissions – Underground Utilities / Paving (Mitigated Tier 2+)

					Aggregate Emissions in Pounds / Day					
Equipment Type	**Qty. Used**	**HP**	**Daily Load Factor (%)**	**Duty Cycle (Hrs. / day)**	**CO**	**NOx**	**SOx**	**PM_{10}**	**$PM_{2.5}$**	**ROG**
Underground Utility Construction / Transmission Line Construction										
Track Backhoe	1	150	50	6	3.7	6.8	0.9	0.1	0.1	1.4
Loader/Drill	1	150	50	6	3.7	6.8	0.9	0.1	0.1	1.4
Water Truck	2	200	50	4	4.6	12.2	1.6	0.2	0.2	1.6
Concrete Truck	8	250	25	0.5	1.4	3.8	0.5	0.1	0.1	0.5
Dump/Haul Trucks	2	300	45	4	6.2	16.4	2.2	0.3	0.3	2.2
				Total for this Construction Task (Σ):	**19.6**	**46.0**	**6.1**	**0.8**	**0.8**	**7.1**
PV System Installation Activities / Tower Placement Activities										
Skid Steer Cat	1	150	50	6	3.7	6.8	0.9	0.1	0.1	1.4
Hydraulic Crane	2	200	25	4	2.3	6.1	0.8	0.1	0.1	1.2
Dump/Haul Trucks	4	300	45	0.5	1.5	4.1	0.5	0.1	0.1	0.5
Paver	1	150	35	8	3.4	6.4	0.8	0.1	0.1	0.4
Roller	1	150	35	8	3.4	6.4	0.8	0.1	0.1	0.8
				Total for this Construction Task (Σ):	**14.3**	**29.8**	**3.8**	**0.5**	**0.5**	**4.3**
				Significance Threshold (ICAPCD):	**550**	**55**	**150**	**150**	**55**	**55**

Fugitive Dust Emission Levels (PM_{10}, $PM_{2.5}$)

Construction activities are also a source of fugitive dust emissions that may have a substantial, but temporary, impact on local air quality. These emissions are typically associated with land clearing, excavating, and construction of a proposed action. Substantial dust emissions also occur when vehicles travel on paved and unpaved surfaces, and haul trucks lose material.

Dust emissions and impacts vary substantially from day to day, depending on the level of activity, the specific operation being conducted, and the prevailing meteorological conditions. Wet dust suppression techniques, such as watering and/or applying chemical stabilization, would be used during construction to suppress the fine dust particulates from leaving the ground surface and becoming airborne through the action of mechanical disturbance or wind motion.

Construction grading operations at the proposed Imperial Solar Energy Center South site are anticipated to be minimal having a worst-case quantity no greater than 250,000 cubic-yards (cy) of material moved over the anticipated 17-month (340-day) construction period.

For alluvium-type material, the project earthwork would have a total working weight of,

$$\text{Working Weight} = 250{,}000 \text{ cubic yards} \times \frac{1.3 \text{ tons}}{\text{cubic yard}} = 325{,}000 \text{ tons}$$

Out of the total quantity identified above, it is estimated that roughly 80-percent of the working weight would be capable of generating PM_{10}. Thus, for the purposes of analysis, the working weight of earthwork material capable of generating some amount of PM_{10} would be 260,000 tons. Thus, the average mass grading earthwork movement per day over the total 340 working days would be 764.7 tons/day.

Following the analysis procedure identified in the *SCAQMD CEQA Handbook* for PM_{10} emissions from fugitive dust gives the following semi-empirical relationship for aggregate respirable dust generation,

$$PM_{10} = 0.00112 \times \left[\frac{\left(\frac{WS}{5}\right)^{1.3}}{\left(\frac{SMC}{2}\right)^{1.4}} \right] \times ET$$

where, PM_{10} = Fugitive dust emissions in pounds,
WS = Ambient wind speed,
SMC = Surface Moisture Content, generally defined as the weight of the water (W_w) divided by the weight of the soil (W_s) as measured at the surface in grams per gram.
ET = Earthwork Tonnage moved per day,

Substituting a minimum SMC value of 0.25 (which is extremely conservative for an ambient dirt/sand condition), and a maximum credible wind speed scenario of 12 MPH (WS = 12), gives the following result,

$$\text{PM}_{10} = 0.00112 \times \left[\frac{\left(\frac{12}{5}\right)^{1.3}}{\left(\frac{0.25}{2}\right)^{1.4}} \right] \times 764.7 = 49.1$$

or, a level of 49.1 pounds of PM_{10} generated per day. It should be noted that surface wetting will be utilized during all phases of earthwork operations at a minimum level of three times per day; thus a control efficiency of 34% to 68% reduction in fugitive dust can be applied per the SCAQMD methodology.

Assuming a median 60% control efficiency, due to the aforementioned watering yields,

$$PM_{10} = (1 - 0.6) \times 49.1 = 19.6$$

or a total fugitive dust generated load of 19.6 pounds per day. This level is far below the 150 pounds per day threshold established by the ICAPCD. Therefore, no impacts are expected from construction grading earthwork particulate matter. The commensurate $PM_{2.5}$ level would be 4.1 pounds per day, which is also below the proposed threshold of significance of 55 pounds per day for this pollutant.

Unpaved road travel due to construction activities is also unknown at this time. For the purposes of analysis, it will be assumed that contractors' vehicles moving onsite would traverse a total of 50 miles per day (VMT) during the earthwork and site preparation phases.

Substituting the applicable project values of VMT = 50, SLP = 6.0 (sand/gravel road with watering), MVS = 10 miles per hour, MVW = 5 tons (gross vehicular weight), NW = 6 wheels (average number of wheels), and RD[27] = 12.0 (rain days), gives the following result,

$$PM_{10} = 50.0 \times \left[2.1 \left(\frac{6}{12} \right) \left(\frac{10}{30} \right) \left(\frac{5}{3} \right)^{0.7} \left(\frac{6}{4} \right)^{0.5} \left(\frac{365 - 12}{365} \right) \right] = 29.6$$

or, a level of approximately 29.6 pounds of PM_{10} generated per day. This activity alone would not generate a significant impact. The commensurate $PM_{2.5}$ level would be 6.3 pounds per day, which is also below the proposed threshold of significance identified above.

Combustion-Fired Health-Risk Emission Levels (PM_{10}, $PM_{2.5}$)

Onsite construction equipment was found to generate worst-case daily pollutant levels during the rough grading phase. These emissions are assumed to occur over any given 24-hour day (thereby providing an upper bound on expected emission concentrations) and direct comparison with CAAQS standards.

[27] Based upon U.S. Weather Service average precipitation year data for Imperial County.

Although all stable criteria pollutants are provided, it should be noted that for cancer-risk potential, only combustion-fired PM_{10} particulates are considered with $PM_{2.5}$ concentrations being determined through the aforementioned fractional emission estimates. This methodology essentially applies all of the diesel emissions over this working area and provides a worst-case assessment of the impacts to sensitive receptors.

The proposed Imperial Solar Energy Center South site has a maximum project footprint of roughly 39,334,680 square-feet (3,654,306 m^2) based upon data obtained from the project site plans. The aggregate Tier 2+ mitigated emission rates for the various criteria pollutants, in grams per second, and grams per square-meter (m^2) per second, are shown in Table 6 below.[28] The expected combustion-fired construction emission concentrations from the *SCREEN3* modeling are shown in Table 7 on the following page. The output model results are provided as an attachment to this report.

TABLE 6: Predicted Onsite Diesel-Fired Construction Emission Rates (Tier 2+)

Criteria Pollutant	Max Daily Emissions (pounds)	Daily Site Emission Rates (grams/second)	Average Area Emission Rates (grams/m^2/second)
CO	29.5	0.1549	4.2381E-08
NO_x	46.0	0.2415	6.6085E-08
SO_x	9.8	0.0514	1.4079E-08
PM_{10}	**1.1**	**0.0058**	**1.5803E-09**
$PM_{2.5}$	1.1	0.0058	1.5803E-09

Total averaging time is 24 hours x 60 minutes/hour x 60 seconds/minute = 86,400 seconds per CAAQS standards.

The area emission rates are shown in scientific notation and are expressed in the form of *mantissa-exponent* to base 10.

One pound-mass = 453.592 grams.

Based upon the model results, all criteria pollutants were below the recommended health risk level with a PM_{10} risk probability of 0.005% per 70-year exposure duration, assuming the implementation of T-BACT. Given this, no significant carcinogenic impact potential is expected due to proposed grading operations.

[28] As a required input parameter for the SCREEN3 model.

TABLE 7: SCREEN3 Predicted Diesel-Fired Emission Concentrations

Criteria Pollutant	Pollutant Concentration (µg/m³)	Pollutant Concentration (ppm)	Pollutant Risk Probability (percent risk per person for 70-year exposure)	Significant?
CO	4.17	0.0036	n/a	**No**
NO_x	6.50	0.0035	n/a	**No**
SO_x	1.39	0.0005	n/a	**No**
PM_{10}	**0.16**	**- -**	**0.005%**	**No**
$PM_{2.5}$	0.14	- -	n/a	**No**

Diesel risk calculation based upon ARB 1999 Staff Report from the Scientific Review Panel (SRP) on Diesel Toxics inhaled in a 70-year lifetime.

Conversion Factors (approximate):

CO: 1 ppm = 1,150 µg/m³ @ 25 deg-C STP, NO_x: 1 ppm = 1,880 µg/m³ @ 25 deg-C STP
SO_x: 1 ppm = 2,620 µg/m³ @ 25 deg-C STP, PM_{10} and $PM_{2.5}$: 1 ppm = 1 g/m³ (solid)

$PM_{2.5}$ levels based upon the CEIDARS database fractional emission factor for diesel construction equipment of 0.920 $PM_{2.5}$ / PM_{10}.

Additionally, the analysis identified a worst-case PM_{10} level of 0.16 µg/m³ occurring at a distance of 1,563 meters (5,127 feet) from the project site. This pollutant concentration is below the California Ambient Air Quality Standard (CAAQS) of 50 µg/m³ established by the State for any given 24-hour exposure period. This predicted diesel-fired PM_{10} dispersion pattern as a function of distance from the site can be seen in Figure 9 on the following page. No cumulative contribution from the site would be physically possible beyond the extents identified in this figure.[29]

Finally, anticipated diesel-fired $PM_{2.5}$ levels would not be expected to exceed 0.14 µg/m³, which is also below the Federal NAAQS 24-hour threshold of 35 µg/m³ (there are no State thresholds for this pollutant). No cumulative contribution of $PM_{2.5}$ from the site would be physically possible due to the reasons cited above.

[29] Which, assuming a standard Gaussian distribution, would yield an effective no impact distance of 20,508 feet (or 3.88 miles).

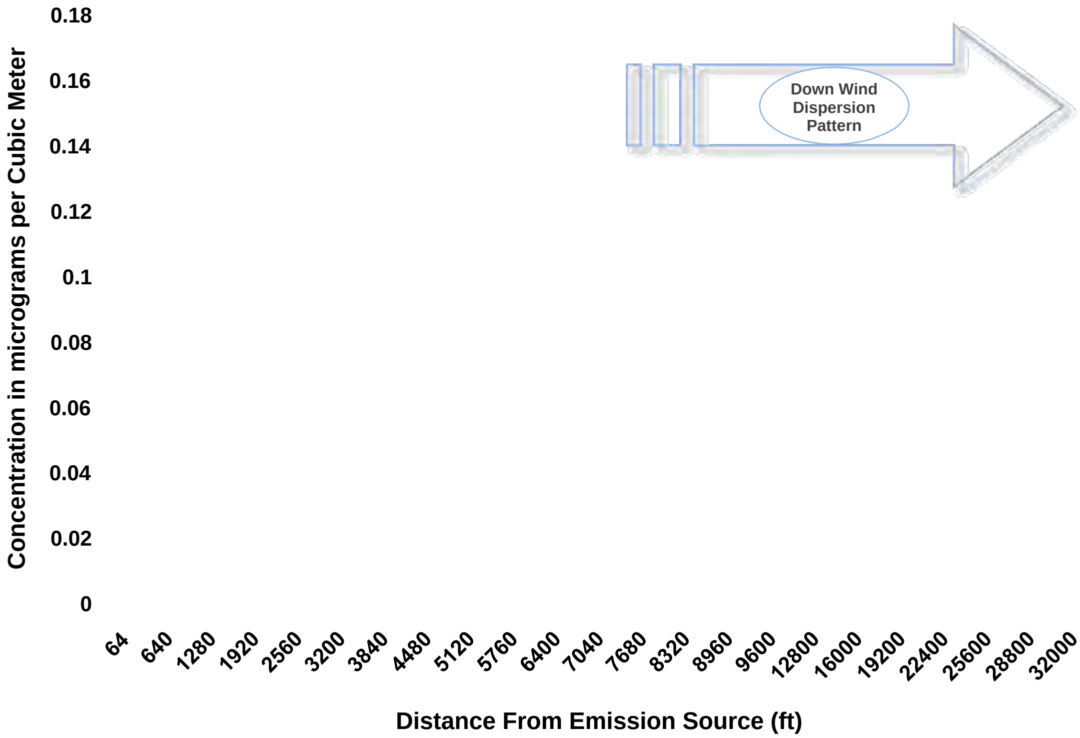

FIGURE 9: Predicted Combustion-Fired Diesel PM_{10} Dispersion Pattern (ISE 8/10)

Odor Impact Potential from Proposed Site

The inhalation of volatile organic compounds (VOC's) causes smell sensations in humans. These odors can affect human health in four primary ways:

- The VOC's can produce toxicological effects;
- The odorant compounds can cause irritations in the eye, nose, and throat;
- The VOC's can stimulate sensory nerves that can cause potentially harmful health effects;
- The exposure to perceived unpleasant odors can stimulate negative cognitive and emotional responses based on previous experiences with such odors.

Development of the proposed project site could generate trace amounts (less than 1 µg/m^3) of substances such as ammonia, carbon dioxide, hydrogen sulfide, methane, dust, organic dust, and endotoxins (i.e., bacteria are present in the dust). Additionally, proposed onsite uses could generate such substances as volatile organic acids, alcohols, aldehydes, amines, fixed gases, carbonyls, esters, sulfides, disulfides, mercaptans, and nitrogen heterocycles. Any odor generation would be intermittent and would terminate upon completion of the construction phase of the project. As a result, no significant air quality impacts are expected. No mitigation for odors is identified.

Construction Vehicular Emission Levels

The Imperial Solar Energy Center South site is expected to have a worst-case construction trip generation level of 680 ADT based upon the cumulative trip generation produced for the proposed project.[30] The average one-way construction trip length would be 15.0 miles. A median speed of 45 MPH was used, consistent with average values observed (i.e., combined highway and surface street traffic activity).

The calculated daily emission levels due to travel to and from the site are shown in Table 8 below. Based upon the findings, no significant impacts for any criteria pollutants were identified. Since these are construction trips, they would be cumulatively added to all other daily construction emissions as can be seen in the following section of this report.

TABLE 8: Operational Trip Emissions – Imperial Solar Energy Center South

		Aggregate Trip Emissions in Pounds / Day					
Development Phase	**ADT**	**CO**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**ROG**
EMFAC 2007 Year 2012 Emission Rates (in grams/mile @ 45 MPH)							
Light Duty Autos (LDA)		2.170	0.319	0.003	0.007	0.007	0.071
Light Duty Trucks (LDT)		3.095	0.535	0.003	0.015	0.015	0.093
Medium Duty Trucks (MDT)		2.446	0.732	0.005	0.014	0.014	0.082
Heavy Duty Trucks (HDT)		3.270	11.008	0.016	0.338	0.337	0.521
Buses (UBUS)		18.491	16.436	0.015	0.091	0.091	1.061
Motorcycles (MCY)		28.685	1.492	0.002	0.024	0.024	2.597
Proposed Project Action @ 680 Net ADT							
Light Duty Autos (LDA):	469	33.67	4.95	0.05	0.11	0.1	1.10
Light Duty Trucks (LDT):	132	13.50	2.33	0.01	0.07	0.1	0.41
Medium Duty Trucks (MDT):	44	3.52	1.05	0.01	0.02	0.0	0.12
Heavy Duty Trucks (HDT):	32	3.46	11.63	0.02	0.36	0.4	0.55
Buses (UBUS):	0	0.00	0.00	0.00	0.00	0.0	0.00
Motorcycles (MCY):	3	3.23	0.17	0.00	0.00	0.0	0.29
Total:	**680**	**57.4**	**20.1**	**0.1**	**0.6**	**0.6**	**2.5**
Significance Threshold (ICAPCD):		**550**	**55**	**150**	**150**	**55**	**55**

Assumes:

Average 15.0-mile trip distance per vehicle (Proposed Project). Salton Sea air basin wintertime conditions (50° F).[31]

For operational traffic, the fractional emission factor is 0.998 $PM_{2.5}$ / PM_{10}.

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[30] Source: *Imperial Solar Energy Center South – Draft Traffic Impact Analysis, LOS Engineering, Inc., 8/2/10.*

[31] Which is the condition whereby pollutant concentrations have the highest persistence and thus are most likely to produce an impact in a CEQA context.

CONCLUSIONS AND RECOMMENDATIONS

Aggregate Project Emissions

The aggregate construction emission levels produced by the proposed Imperial Solar Energy Center South project site are shown in Table 9 below. Aggregate operational NO_x emissions are indicated which would require additional mitigation identified at the end of this section.

TABLE 9: Aggregate Emissions Synopsis – Imperial Solar Energy Center South

	Aggregate Emissions in Pounds / Day					
SCENARIO EXAMINED	**CO**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**[32]	**ROG**
Construction Grading Operations						
Grading Emissions (Tier 0 Baseline)	*45.3*	*103.5*	*9.8*	*7.0*	*6.5*	*10.3*
Grading Emissions (Tier 2+ Mitigated)	29.5	32.4	9.8	1.1	1.1	10.3
Surface Grading Dust Generation	- -	- -	- -	19.6	4.1	- -
Powered Haulage Dust Generation	0.0	0.0	0.0	29.6	6.3	0.0
Construction Traffic Generation (Table 8)	57.4	20.1	0.1	0.6	0.6	2.5
Total (Σ):	**86.9**	**52.5**	**9.9**	**50.9**	**12.1**	**12.8**
Significance Threshold (ICAPCD):	**550**	**55**	**150**	**150**	**55**	**55**

Consistency with Regional Air Quality Management Plans

Finally, the Imperial County APCD establishes what could be thought of as an *"emissions budget"* or Regional Air Quality Strategy (RAQS) for the Salton Sea Air Basin. This budget takes into account existing conditions, planned growth based on General Plans for cities within the region, and air quality control measures implemented by the ICAPCD.

The "emissions budget" accounts for current emissions associated with the proposed project, as well as previously approved projects consistent with current General Plan policies. Therefore, determining whether the proposed project is consistent with the RAQS requires a comparison of net emissions from the proposed development to the emissions associated with previously approved and accounted for plans (commonly known as the *Consistency Criterion* of the RAQS).

[32] Values shown in this column are for informational purposes only. $PM_{2.5}$ emissions are not currently regulated by CARB. The 55 pound-per-day level shown is a proposed standard that has not been adopted.

The proposed Imperial Solar Energy Center South is consistent with future build out plans for the project site under the County's General Plan as well as with the State's definition of an *"eligible renewable energy resource"* in Section 399.12 of the California Public Utilities Code and the definition of "*in-state renewable electricity generation facility"* in Section 25741 of the California Public Resources Code, and therefore satisfies the *Consistency Criterion* of the RAQS.

ICAPCD Standard Construction Control Measures

All construction sites, regardless of size, must comply with ICAPCD Regulation VIII requirements.

Standard Mitigation Measures for Fugitive PM_{10} Control

a. All disturbed areas, including Bulk Material storage which is not being actively utilized, shall be effectively stabilized and visible emissions shall be limited to no greater than 20% opacity for dust emissions by using water, chemical stabilizers, dust suppressants, tarps or other suitable material such as vegetative ground cover.

b. All on site and off site unpaved roads will be effectively stabilized and visible emissions shall be limited to no greater than 20% opacity for dust emissions by paving, chemical stabilizers, dust suppressants and/or watering.

c. All unpaved traffic areas one (1) acre or more with 75 or more average vehicle trips per day will be effectively stabilized and visible emission shall be limited to no greater than 20% opacity for dust emissions by paving, chemical stabilizers, dust suppressants and/or watering.

d. The transport of Bulk Materials shall be completely covered unless six inches of freeboard space from the top of the container is maintained with no spillage and loss of Bulk Material. In addition, the cargo compartment of all Haul Trucks is to be cleaned and/or washed at delivery site after removal of Bulk Material.

e. All Track-Out or Carry-Out will be cleaned at the end of each workday or immediately when mud or dirt extends a cumulative distance of 50 linear feet or more onto a paved road within an Urban area.

f. Movement of Bulk Material handling or transfer shall be stabilized prior to handling or at points of transfer with application of sufficient water, chemical stabilizers or by sheltering or enclosing the operation and transfer line.

g. The construction of any new Unpaved Road is prohibited within any area with a population of 500 or more unless the road meets the definition of a Temporary Unpaved Road. Any temporary unpaved road shall be effectively stabilized and visible emissions shall be limited to no greater than 20% opacity for dust emission by paving, chemical stabilizers, dust suppressants and/or watering.

Discretionary Mitigation Measures for Fugitive PM_{10} Control

a. Water exposed soil with adequate frequency for continued moist soil.

b. Replace ground cover in disturbed areas as quickly as possible.

c. Automatic sprinkler system installed on all soil piles.

d. Vehicle speed for all construction vehicles shall not exceed 15 mph on any unpaved surface at the construction site.

e. Develop a trip reduction plan to achieve a 1.5 AVR for construction employees.

f. Implement a shuttle service to and from retail services and food establishments during lunch hours.

Standard Mitigation Measures for Construction Combustion Equipment

a. Use of alternative fueled or catalyst equipped diesel construction equipment, including all off-road and portable diesel powered equipment.

b. Minimize idling time either by shutting equipment off when not in use or reducing the time of idling to 5 minutes as a maximum.

c. Limit, to the extent feasible, the hours of operation of heavy-duty equipment and/or the amount of equipment in use.

d. Replace fossil fueled equipment with electrically driven equivalents (provided they are not run via a portable generator set).

Enhanced Mitigation Measures for Construction Equipment

a. Curtail construction during periods of high ambient pollutant concentrations; this may include ceasing of construction activity during the peak hour of vehicular traffic on adjacent roadways.

b. Implement activity management (e.g. rescheduling activities to reduce short-term impacts).

Construction Mitigation Measures Imposed by AQIA

Construction NO_x emissions were found to be approximately 1.8 times greater than the allowable threshold. Application of Tier 2+ Blue Sky engine equipment (which is consistent with Tier 3 or better equipment) was found to mitigate construction NO_x impacts to below a level of significance. Therefore, the project would be required to utilize newer mass grading equipment meeting the above standards.

CERTIFICATION OF ACCURACY AND QUALIFICATIONS

This report was prepared by Investigative Science and Engineering, Inc. (ISE), located at 1134 D Street, Ramona, CA 92065. The members of its professional staff contributing to the report are listed below:

Rick Tavares *(rtavares@ise.us)*	Ph.D. Civil Engineering M.S. Structural Engineering M.S. Mechanical Engineering B.S. Aerospace Engineering / Engineering Mechanics
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ISE affirms to the best of its knowledge and belief that the statements and information contained herein are in all respects true and correct as of the date of this report. Should the reader have any questions regarding the findings and conclusions presented in this report, please do not hesitate to contact ISE at (760) 787-0016.

Content and information contained within this report is intended only for the subject project and is protected under 17 U.S.C. §§ 101 through 810. Original reports contain a non-photo blue ISE watermark at the bottom of each page.

Approved as to Form and Content:

Rick Tavares

Rick Tavares, Ph.D.

Project Principal
Investigative Science and Engineering, Inc. (ISE)

APPENDICES / SUPPLEMENTAL INFORMATION

EMFAC 2007 EMISSION FACTOR TABULATIONS – SCENARIO YEAR 2012

```
Title    : Salton Sea Air Basin Avg Winter CYr 2012
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2010/08/17 16:56:09
Scen Year: 2012 -- All model years in the range 1968 to 2012 selected
Season   : Winter
Area     : Salton Sea
*****************************************************************************************
     Year: 2012 -- Model Years 1968 to 2012 Inclusive -- Winter
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

         Salton Sea                      Basin Average                  Basin Average

                              Table  1:  Running Exhaust Emissions (grams/mile)

     Pollutant Name: Reactive Org Gases        Temperature:  50F  Relative Humidity:  40%
```

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
10	0.323	0.386	0.380	4.479	6.130	4.169	0.988
15	0.223	0.272	0.263	2.189	4.218	3.363	0.554
20	0.161	0.201	0.192	1.202	3.024	2.849	0.349
25	0.124	0.156	0.147	0.971	2.259	2.534	0.278
30	0.100	0.127	0.119	0.790	1.758	2.368	0.228
35	0.085	0.109	0.100	0.656	1.426	2.325	0.194
40	0.076	0.098	0.088	0.567	1.205	2.398	0.172
45	0.071	0.093	0.082	0.521	1.061	2.597	0.163
50	0.071	0.092	0.080	0.519	0.975	2.953	0.164
55	0.074	0.097	0.083	0.560	0.933	3.523	0.177
60	0.082	0.106	0.090	0.643	0.932	4.406	0.202
65	0.096	0.122	0.103	0.769	0.970	5.775	0.242

```
     Pollutant Name: Carbon Monoxide           Temperature:  50F  Relative Humidity:  40%
```

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
10	4.038	5.952	5.025	12.142	69.990	28.797	6.104
15	3.562	5.149	4.239	8.568	48.995	25.102	5.009
20	3.189	4.545	3.679	6.400	36.259	22.881	4.263
25	2.890	4.081	3.266	5.359	28.364	21.803	3.785
30	2.647	3.722	2.957	4.561	23.454	21.734	3.417
35	2.450	3.445	2.726	3.961	20.500	22.696	3.140
40	2.292	3.238	2.558	3.535	18.938	24.878	2.943
45	2.170	3.095	2.446	3.270	18.491	28.685	2.821
50	2.083	3.018	2.391	3.163	19.083	34.861	2.780
55	2.036	3.014	2.400	3.218	20.813	44.724	2.836
60	2.037	3.104	2.492	3.447	23.992	60.622	3.016
65	2.104	3.326	2.699	3.876	29.230	86.843	3.377

Pollutant Name: Oxides of Nitrogen Temperature: 50F Relative Humidity: 40%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
10	0.497	0.832	1.043	20.494	20.799	1.323	3.616
15	0.441	0.733	0.924	15.026	17.922	1.321	2.743
20	0.400	0.660	0.839	12.828	16.183	1.330	2.369
25	0.369	0.607	0.781	12.188	15.217	1.348	2.239
30	0.346	0.571	0.743	11.688	14.822	1.373	2.141
35	0.331	0.548	0.724	11.324	14.899	1.406	2.072
40	0.322	0.536	0.720	11.097	15.422	1.446	2.031
45	0.319	0.535	0.732	11.008	16.436	1.492	2.019
50	0.322	0.545	0.760	11.061	18.066	1.546	2.035
55	0.330	0.567	0.809	11.261	20.552	1.607	2.082
60	0.344	0.602	0.882	11.620	24.318	1.676	2.162
65	0.365	0.654	0.988	12.155	30.108	1.755	2.281

Pollutant Name: Sulfur Dioxide Temperature: 50F Relative Humidity: 40%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
10	0.007	0.009	0.012	0.028	0.022	0.003	0.011
15	0.005	0.007	0.009	0.023	0.019	0.002	0.009
20	0.004	0.006	0.008	0.020	0.017	0.002	0.007
25	0.004	0.005	0.006	0.019	0.016	0.002	0.006
30	0.003	0.004	0.006	0.017	0.016	0.002	0.006
35	0.003	0.004	0.005	0.017	0.015	0.002	0.005
40	0.003	0.004	0.005	0.016	0.015	0.002	0.005
45	0.003	0.003	0.005	0.016	0.015	0.002	0.005
50	0.003	0.004	0.005	0.015	0.015	0.002	0.005
55	0.003	0.004	0.005	0.015	0.015	0.002	0.005
60	0.003	0.004	0.006	0.015	0.016	0.003	0.006
65	0.004	0.005	0.006	0.016	0.016	0.003	0.006

Pollutant Name: PM10 Temperature: 50F Relative Humidity: 40%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
10	0.033	0.066	0.064	1.115	0.337	0.035	0.205
15	0.022	0.046	0.044	0.742	0.250	0.029	0.138
20	0.016	0.033	0.032	0.527	0.193	0.025	0.098
25	0.012	0.026	0.025	0.445	0.155	0.023	0.081
30	0.010	0.021	0.020	0.386	0.128	0.021	0.070
35	0.008	0.017	0.017	0.348	0.110	0.021	0.062
40	0.007	0.016	0.015	0.332	0.098	0.022	0.059
45	0.007	0.015	0.014	0.338	0.091	0.024	0.059
50	0.007	0.014	0.014	0.365	0.087	0.027	0.063
55	0.007	0.015	0.014	0.413	0.086	0.032	0.070
60	0.008	0.016	0.016	0.483	0.089	0.040	0.081
65	0.009	0.019	0.018	0.574	0.094	0.052	0.096

SCREEN3 Model Output for Criteria Pollutants: CO, NO_x, SO_x, and PM_{10}

```
                                                                 08/17/10
                                                                 19:24:43
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

IMPERIAL SOLAR ENERGY CENTER (SOUTH) GRADING AND CONSTRUCTION - CO

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE                =        AREA
   EMISSION RATE (G/(S-M**2)) =      .423810E-07
   SOURCE HEIGHT (M)          =       3.0000
   LENGTH OF LARGER SIDE (M)  =    1911.6000
   LENGTH OF SMALLER SIDE (M) =    1911.6000
   RECEPTOR HEIGHT (M)        =      10.0000
   URBAN/RURAL OPTION         =        RURAL
THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

   MODEL ESTIMATES DIRECTION TO MAX CONCENTRATION


BUOY. FLUX =     .000 M**4/S**3;  MOM. FLUX =     .000 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

  DIST     CONC           U10M   USTK  MIX HT   PLUME  MAX DIR
   (M)   (UG/M**3)  STAB  (M/S)  (M/S)   (M)    HT (M)  (DEG)
-------  ----------  ----  -----  -----  ------  ------  -------
    20.   2.134        6     1.0    1.0 10000.0    3.00     44.
   100.   2.269        6     1.0    1.0 10000.0    3.00     45.
   200.   2.424        6     1.0    1.0 10000.0    3.00     45.
   300.   2.574        6     1.0    1.0 10000.0    3.00     45.
   400.   2.721        6     1.0    1.0 10000.0    3.00     45.
   500.   2.863        6     1.0    1.0 10000.0    3.00     45.
   600.   3.003        6     1.0    1.0 10000.0    3.00     45.
   700.   3.139        6     1.0    1.0 10000.0    3.00     45.
   800.   3.274        6     1.0    1.0 10000.0    3.00     45.
   900.   3.406        6     1.0    1.0 10000.0    3.00     45.
  1000.   3.536        6     1.0    1.0 10000.0    3.00     45.
  1100.   3.665        6     1.0    1.0 10000.0    3.00     45.
  1200.   3.791        6     1.0    1.0 10000.0    3.00     45.
  1300.   3.977        6     1.0    1.0 10000.0    3.00     42.
  1400.   4.062        6     1.0    1.0 10000.0    3.00     45.
  1500.   4.151        6     1.0    1.0 10000.0    3.00     45.
  1600.   4.165        6     1.0    1.0 10000.0    3.00     45.
  1700.   4.113        6     1.0    1.0 10000.0    3.00     45.
  1800.   4.030        6     1.0    1.0 10000.0    3.00     45.
  1900.   3.934        6     1.0    1.0 10000.0    3.00     45.
  2000.   3.834        6     1.0    1.0 10000.0    3.00     45.
  2100.   3.738        6     1.0    1.0 10000.0    3.00     45.
  2200.   3.645        6     1.0    1.0 10000.0    3.00     45.
  2300.   3.556        6     1.0    1.0 10000.0    3.00     45.
  2400.   3.473        6     1.0    1.0 10000.0    3.00     45.
  2500.   3.396        6     1.0    1.0 10000.0    3.00     45.
  2600.   3.323        6     1.0    1.0 10000.0    3.00     45.
  2700.   3.254        6     1.0    1.0 10000.0    3.00     45.
  2800.   3.188        6     1.0    1.0 10000.0    3.00     45.
  2900.   3.127        6     1.0    1.0 10000.0    3.00     45.
  3000.   3.070        6     1.0    1.0 10000.0    3.00     45.
```

```
  3500.   2.828        6     1.0     1.0 10000.0    3.00     45.
  4000.   2.638        6     1.0     1.0 10000.0    3.00     45.
  4500.   2.484        6     1.0     1.0 10000.0    3.00     45.
  5000.   2.353        6     1.0     1.0 10000.0    3.00     45.
  5500.   2.238        6     1.0     1.0 10000.0    3.00     45.
  6000.   2.136        6     1.0     1.0 10000.0    3.00     45.
  6500.   2.046        6     1.0     1.0 10000.0    3.00     45.
  7000.   1.965        6     1.0     1.0 10000.0    3.00     45.
  7500.   1.894        6     1.0     1.0 10000.0    3.00     45.
  8000.   1.829        6     1.0     1.0 10000.0    3.00     45.
  8500.   1.771        6     1.0     1.0 10000.0    3.00     45.
  9000.   1.716        6     1.0     1.0 10000.0    3.00     45.
  9500.   1.666        6     1.0     1.0 10000.0    3.00     45.
 10000.   1.618        6     1.0     1.0 10000.0    3.00     45.

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND    20. M:
  1563.   4.170        6     1.0     1.0 10000.0    3.00     45.

     ***************************************
     *** SUMMARY OF SCREEN MODEL RESULTS ***
     ***************************************

 CALCULATION         MAX CONC    DIST TO   TERRAIN
  PROCEDURE         (UG/M**3)    MAX (M)    HT (M)
--------------     -----------   -------   -------
SIMPLE TERRAIN       4.170         1563.        0.
```

```
                                                          08/17/10
                                                          19:24:43
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

IMPERIAL SOLAR ENERGY CENTER (SOUTH) GRADING AND CONSTRUCTION - NOX

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE                =         AREA
   EMISSION RATE (G/(S-M**2)) =      .660850E-07
   SOURCE HEIGHT (M)          =       3.0000
   LENGTH OF LARGER SIDE (M)  =    1911.6000
   LENGTH OF SMALLER SIDE (M) =    1911.6000
   RECEPTOR HEIGHT (M)        =      10.0000
   URBAN/RURAL OPTION         =        RURAL
THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

   MODEL ESTIMATES DIRECTION TO MAX CONCENTRATION


BUOY. FLUX =     .000 M**4/S**3;  MOM. FLUX =     .000 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

  DIST     CONC            U10M   USTK  MIX HT   PLUME   MAX DIR
   (M)    (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)   (DEG)
-------  ----------  ----  -----  -----  ------  ------  -------
    20.   3.328        6     1.0    1.0 10000.0    3.00     44.
   100.   3.538        6     1.0    1.0 10000.0    3.00     45.
   200.   3.780        6     1.0    1.0 10000.0    3.00     45.
   300.   4.014        6     1.0    1.0 10000.0    3.00     45.
   400.   4.242        6     1.0    1.0 10000.0    3.00     45.
   500.   4.465        6     1.0    1.0 10000.0    3.00     45.
   600.   4.682        6     1.0    1.0 10000.0    3.00     45.
   700.   4.895        6     1.0    1.0 10000.0    3.00     45.
   800.   5.105        6     1.0    1.0 10000.0    3.00     45.
   900.   5.311        6     1.0    1.0 10000.0    3.00     45.
  1000.   5.514        6     1.0    1.0 10000.0    3.00     45.
  1100.   5.714        6     1.0    1.0 10000.0    3.00     45.
  1200.   5.912        6     1.0    1.0 10000.0    3.00     45.
  1300.   6.202        6     1.0    1.0 10000.0    3.00     42.
  1400.   6.335        6     1.0    1.0 10000.0    3.00     45.
  1500.   6.473        6     1.0    1.0 10000.0    3.00     45.
  1600.   6.495        6     1.0    1.0 10000.0    3.00     45.
  1700.   6.413        6     1.0    1.0 10000.0    3.00     45.
  1800.   6.285        6     1.0    1.0 10000.0    3.00     45.
  1900.   6.134        6     1.0    1.0 10000.0    3.00     45.
  2000.   5.979        6     1.0    1.0 10000.0    3.00     45.
  2100.   5.828        6     1.0    1.0 10000.0    3.00     45.
  2200.   5.683        6     1.0    1.0 10000.0    3.00     45.
  2300.   5.545        6     1.0    1.0 10000.0    3.00     45.
  2400.   5.415        6     1.0    1.0 10000.0    3.00     45.
  2500.   5.295        6     1.0    1.0 10000.0    3.00     45.
  2600.   5.181        6     1.0    1.0 10000.0    3.00     45.
  2700.   5.073        6     1.0    1.0 10000.0    3.00     45.
  2800.   4.971        6     1.0    1.0 10000.0    3.00     45.
  2900.   4.876        6     1.0    1.0 10000.0    3.00     45.
  3000.   4.787        6     1.0    1.0 10000.0    3.00     45.
  3500.   4.410        6     1.0    1.0 10000.0    3.00     45.
  4000.   4.114        6     1.0    1.0 10000.0    3.00     45.
  4500.   3.874        6     1.0    1.0 10000.0    3.00     45.
```

```
  5000.   3.669        6     1.0     1.0 10000.0    3.00     45.
  5500.   3.489        6     1.0     1.0 10000.0    3.00     45.
  6000.   3.330        6     1.0     1.0 10000.0    3.00     45.
  6500.   3.190        6     1.0     1.0 10000.0    3.00     45.
  7000.   3.065        6     1.0     1.0 10000.0    3.00     45.
  7500.   2.953        6     1.0     1.0 10000.0    3.00     45.
  8000.   2.852        6     1.0     1.0 10000.0    3.00     45.
  8500.   2.761        6     1.0     1.0 10000.0    3.00     45.
  9000.   2.676        6     1.0     1.0 10000.0    3.00     45.
  9500.   2.597        6     1.0     1.0 10000.0    3.00     45.
 10000.   2.523        6     1.0     1.0 10000.0    3.00     45.

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND    20. M:
  1563.   6.502        6     1.0     1.0 10000.0    3.00     45.

     ***************************************
     *** SUMMARY OF SCREEN MODEL RESULTS ***
     ***************************************

 CALCULATION         MAX CONC     DIST TO    TERRAIN
  PROCEDURE         (UG/M**3)     MAX (M)     HT (M)
--------------    -----------    -------    -------
SIMPLE TERRAIN       6.502          1563.         0.
```

08/17/10
19:24:44

*** SCREEN3 MODEL RUN ***
*** VERSION DATED 96043 ***

IMPERIAL SOLAR ENERGY CENTER (SOUTH) GRADING AND CONSTRUCTION - SOX

```
SIMPLE TERRAIN INPUTS:
   SOURCE TYPE                =         AREA
   EMISSION RATE (G/(S-M**2)) =      .140790E-07
   SOURCE HEIGHT (M)          =       3.0000
   LENGTH OF LARGER SIDE (M)  =    1911.6000
   LENGTH OF SMALLER SIDE (M) =    1911.6000
   RECEPTOR HEIGHT (M)        =      10.0000
   URBAN/RURAL OPTION         =        RURAL
THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

   MODEL ESTIMATES DIRECTION TO MAX CONCENTRATION


BUOY. FLUX =     .000 M**4/S**3;  MOM. FLUX =     .000 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***
```

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	MAX DIR (DEG)
20.	.7091	6	1.0	1.0	10000.0	3.00	44.
100.	.7539	6	1.0	1.0	10000.0	3.00	45.
200.	.8052	6	1.0	1.0	10000.0	3.00	45.
300.	.8551	6	1.0	1.0	10000.0	3.00	45.
400.	.9038	6	1.0	1.0	10000.0	3.00	45.
500.	.9512	6	1.0	1.0	10000.0	3.00	45.
600.	.9975	6	1.0	1.0	10000.0	3.00	45.
700.	1.043	6	1.0	1.0	10000.0	3.00	45.
800.	1.088	6	1.0	1.0	10000.0	3.00	45.
900.	1.131	6	1.0	1.0	10000.0	3.00	45.
1000.	1.175	6	1.0	1.0	10000.0	3.00	45.
1100.	1.217	6	1.0	1.0	10000.0	3.00	45.
1200.	1.259	6	1.0	1.0	10000.0	3.00	45.
1300.	1.321	6	1.0	1.0	10000.0	3.00	42.
1400.	1.350	6	1.0	1.0	10000.0	3.00	45.
1500.	1.379	6	1.0	1.0	10000.0	3.00	45.
1600.	1.384	6	1.0	1.0	10000.0	3.00	45.
1700.	1.366	6	1.0	1.0	10000.0	3.00	45.
1800.	1.339	6	1.0	1.0	10000.0	3.00	45.
1900.	1.307	6	1.0	1.0	10000.0	3.00	45.
2000.	1.274	6	1.0	1.0	10000.0	3.00	45.
2100.	1.242	6	1.0	1.0	10000.0	3.00	45.
2200.	1.211	6	1.0	1.0	10000.0	3.00	45.
2300.	1.181	6	1.0	1.0	10000.0	3.00	45.
2400.	1.154	6	1.0	1.0	10000.0	3.00	45.
2500.	1.128	6	1.0	1.0	10000.0	3.00	45.
2600.	1.104	6	1.0	1.0	10000.0	3.00	45.
2700.	1.081	6	1.0	1.0	10000.0	3.00	45.
2800.	1.059	6	1.0	1.0	10000.0	3.00	45.
2900.	1.039	6	1.0	1.0	10000.0	3.00	45.
3000.	1.020	6	1.0	1.0	10000.0	3.00	45.
3500.	.9396	6	1.0	1.0	10000.0	3.00	45.
4000.	.8765	6	1.0	1.0	10000.0	3.00	45.
4500.	.8253	6	1.0	1.0	10000.0	3.00	45.

```
  5000.   .7816        6     1.0     1.0 10000.0    3.00     45.
  5500.   .7433        6     1.0     1.0 10000.0    3.00     45.
  6000.   .7095        6     1.0     1.0 10000.0    3.00     45.
  6500.   .6795        6     1.0     1.0 10000.0    3.00     45.
  7000.   .6529        6     1.0     1.0 10000.0    3.00     45.
  7500.   .6291        6     1.0     1.0 10000.0    3.00     45.
  8000.   .6076        6     1.0     1.0 10000.0    3.00     45.
  8500.   .5882        6     1.0     1.0 10000.0    3.00     45.
  9000.   .5702        6     1.0     1.0 10000.0    3.00     45.
  9500.   .5533        6     1.0     1.0 10000.0    3.00     45.
 10000.   .5376        6     1.0     1.0 10000.0    3.00     45.

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND    20. M:
  1563.   1.385        6     1.0     1.0 10000.0    3.00     45.

     ***************************************
     *** SUMMARY OF SCREEN MODEL RESULTS ***
     ***************************************

 CALCULATION         MAX CONC    DIST TO   TERRAIN
  PROCEDURE         (UG/M**3)    MAX (M)    HT (M)
--------------     -----------   -------   -------
SIMPLE TERRAIN       1.385         1563.        0.
```

```
                                                                    08/17/10
                                                                    19:24:44
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

IMPERIAL SOLAR ENERGY CENTER (SOUTH) GRADING AND CONSTRUCTION - PM10

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE                 =        AREA
   EMISSION RATE (G/(S-M**2))  =      .158030E-08
   SOURCE HEIGHT (M)           =       3.0000
   LENGTH OF LARGER SIDE (M)   =    1911.6000
   LENGTH OF SMALLER SIDE (M)  =    1911.6000
   RECEPTOR HEIGHT (M)         =      10.0000
   URBAN/RURAL OPTION          =       RURAL
THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

   MODEL ESTIMATES DIRECTION TO MAX CONCENTRATION


BUOY. FLUX =     .000 M**4/S**3;  MOM. FLUX =     .000 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

  DIST     CONC             U10M   USTK  MIX HT   PLUME  MAX DIR
   (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)  (DEG)
-------  ----------  ----  -----  -----  ------  ------  -------
    20.   .7959E-01    6     1.0    1.0 10000.0    3.00     44.
   100.   .8462E-01    6     1.0    1.0 10000.0    3.00     45.
   200.   .9038E-01    6     1.0    1.0 10000.0    3.00     45.
   300.   .9599E-01    6     1.0    1.0 10000.0    3.00     45.
   400.   .1014        6     1.0    1.0 10000.0    3.00     45.
   500.   .1068        6     1.0    1.0 10000.0    3.00     45.
   600.   .1120        6     1.0    1.0 10000.0    3.00     45.
   700.   .1171        6     1.0    1.0 10000.0    3.00     45.
   800.   .1221        6     1.0    1.0 10000.0    3.00     45.
   900.   .1270        6     1.0    1.0 10000.0    3.00     45.
  1000.   .1319        6     1.0    1.0 10000.0    3.00     45.
  1100.   .1366        6     1.0    1.0 10000.0    3.00     45.
  1200.   .1414        6     1.0    1.0 10000.0    3.00     45.
  1300.   .1483        6     1.0    1.0 10000.0    3.00     42.
  1400.   .1515        6     1.0    1.0 10000.0    3.00     45.
  1500.   .1548        6     1.0    1.0 10000.0    3.00     45.
  1600.   .1553        6     1.0    1.0 10000.0    3.00     45.
  1700.   .1534        6     1.0    1.0 10000.0    3.00     45.
  1800.   .1503        6     1.0    1.0 10000.0    3.00     45.
  1900.   .1467        6     1.0    1.0 10000.0    3.00     45.
  2000.   .1430        6     1.0    1.0 10000.0    3.00     45.
  2100.   .1394        6     1.0    1.0 10000.0    3.00     45.
  2200.   .1359        6     1.0    1.0 10000.0    3.00     45.
  2300.   .1326        6     1.0    1.0 10000.0    3.00     45.
  2400.   .1295        6     1.0    1.0 10000.0    3.00     45.
  2500.   .1266        6     1.0    1.0 10000.0    3.00     45.
  2600.   .1239        6     1.0    1.0 10000.0    3.00     45.
  2700.   .1213        6     1.0    1.0 10000.0    3.00     45.
  2800.   .1189        6     1.0    1.0 10000.0    3.00     45.
  2900.   .1166        6     1.0    1.0 10000.0    3.00     45.
  3000.   .1145        6     1.0    1.0 10000.0    3.00     45.
  3500.   .1055        6     1.0    1.0 10000.0    3.00     45.
  4000.   .9838E-01    6     1.0    1.0 10000.0    3.00     45.
  4500.   .9264E-01    6     1.0    1.0 10000.0    3.00     45.
```

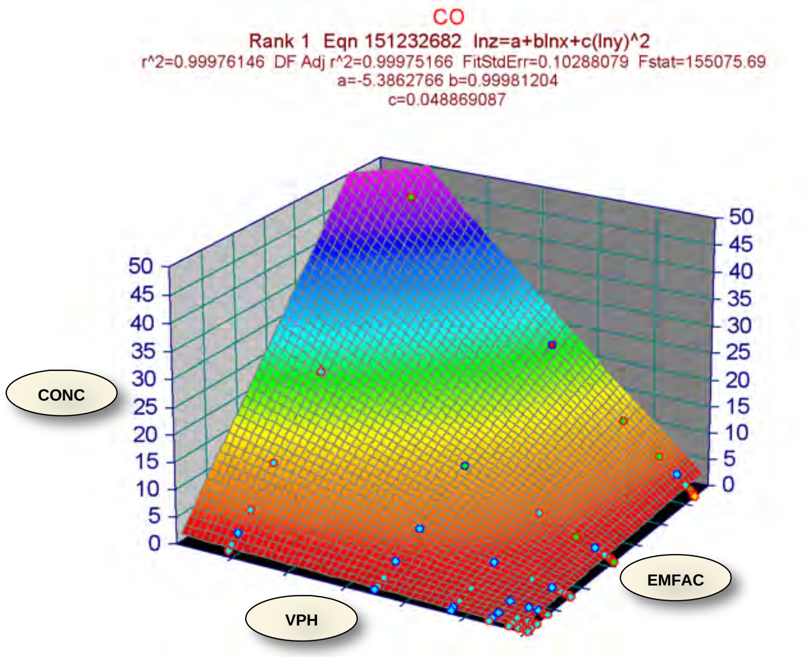
```
  5000.   .8773E-01    6     1.0     1.0 10000.0    3.00     45.
  5500.   .8344E-01    6     1.0     1.0 10000.0    3.00     45.
  6000.   .7964E-01    6     1.0     1.0 10000.0    3.00     45.
  6500.   .7628E-01    6     1.0     1.0 10000.0    3.00     45.
  7000.   .7329E-01    6     1.0     1.0 10000.0    3.00     45.
  7500.   .7061E-01    6     1.0     1.0 10000.0    3.00     45.
  8000.   .6820E-01    6     1.0     1.0 10000.0    3.00     45.
  8500.   .6602E-01    6     1.0     1.0 10000.0    3.00     45.
  9000.   .6400E-01    6     1.0     1.0 10000.0    3.00     45.
  9500.   .6211E-01    6     1.0     1.0 10000.0    3.00     45.
 10000.   .6034E-01    6     1.0     1.0 10000.0    3.00     45.

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND    20. M:
  1563.   .1555        6     1.0     1.0 10000.0    3.00     45.

     ***************************************
     *** SUMMARY OF SCREEN MODEL RESULTS ***
     ***************************************

 CALCULATION         MAX CONC    DIST TO   TERRAIN
  PROCEDURE         (UG/M**3)    MAX (M)    HT (M)
--------------     -----------   -------   -------
SIMPLE TERRAIN       .1555        1563.        0.
```

CALINE4 SOLUTION SPACE RESULTS – SCENARIO CO

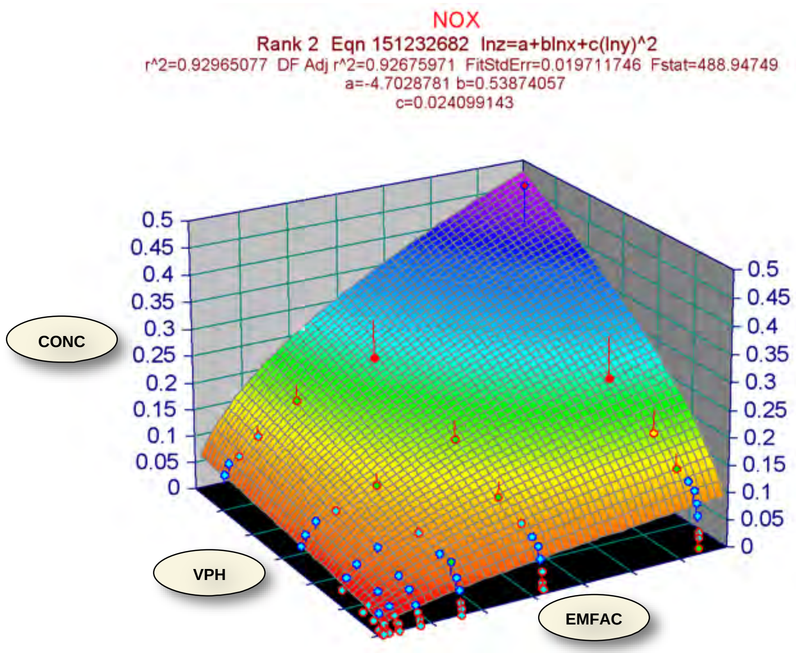


Rank 1 Eqn 151232682 $\ln z=a+b\ln x+c(\ln y)^2$

r^2 Coef Det	DF Adj r^2	Fit Std Err	F-value
0.9997614637	0.9997516609	0.102880788	155075.68815

Parm	Value	Std Error	t-value	95.00% Confidence Limits		P>|t|
a	-5.38627658	0.022750405	-236.75519	-5.43160775	-5.34094541	0.00000
b	0.999812043	0.003657036	273.3940571	0.992525238	1.007098847	0.00000
c	0.048869087	0.000171868	284.3402911	0.048526632	0.049211542	0.00000

CALINE4 SOLUTION SPACE RESULTS – SCENARIO NO_X

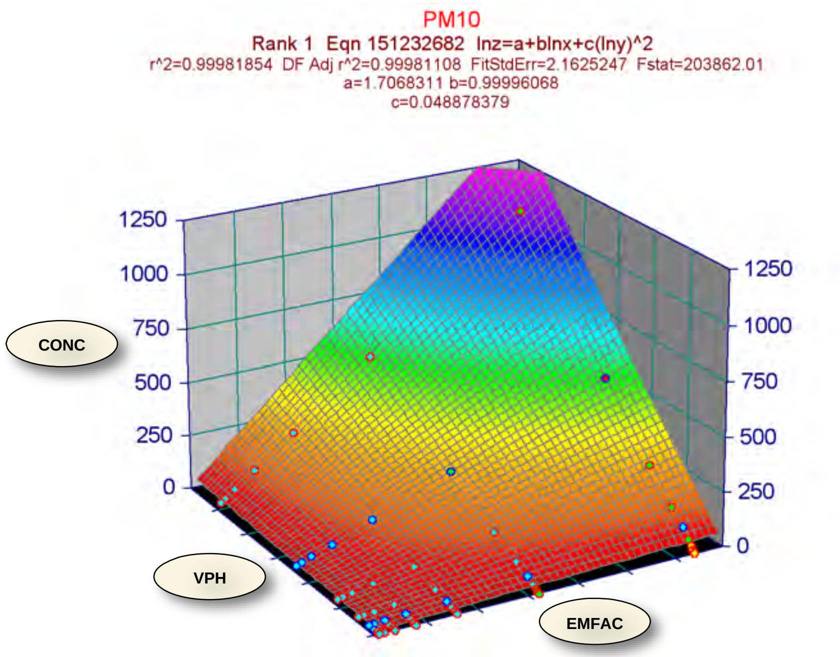


Rank 1 Eqn 151232653 $\ln z=a+bx^{0.5}+c(\ln y)^2$

r^2 Coef Det	DF Adj r^2	Fit Std Err	F-value
0.9311638335	0.9283349499	0.0194986151	500.50814223

Parm	Value	Std Error	t-value	95.00% Confidence Limits		P>|t|
a	-5.48793064	0.131941715	-41.593598	-5.75083025	-5.22503104	0.00000
b	0.756396215	0.037072879	20.40295328	0.682526891	0.830265538	0.00000
c	0.023350423	0.001103789	21.15477893	0.021151074	0.025549771	0.00000

CALINE4 SOLUTION SPACE RESULTS – SCENARIO PM_{10}



Rank 1 Eqn 151232682 $\ln z = a + b\ln x + c(\ln y)^2$

r^2 Coef Det	DF Adj r^2	Fit Std Err	F-value
0.9998185376	0.9998110803	2.1625247335	203862.00724

Parm	Value	Std Error	t-value	95.00% Confidence Limits		P>|t|
a	1.706831053	0.01706339	100.0288368	1.672831506	1.7408306	0.00000
b	0.999960683	0.003187502	313.7129842	0.993609447	1.006311919	0.00000
c	0.048878379	0.000149717	326.4708691	0.048580061	0.049176698	0.00000

INDEX OF IMPORTANT TERMS

Imperial Solar Energy Center South

Appendix C2

Construction Greenhouse Gas/Global Warming Risk Assessment

Prepared by Investigative Science and Engineering, Inc.

August 19, 2010

CONSTRUCTION GREENHOUSE GAS / GLOBAL WARMING RISK ASSESSMENT
IMPERIAL SOLAR ENERGY CENTER SOUTH
IMPERIAL COUNTY, CA

Submitted to:

Mr. Tim Gnibus
BRG Consulting, Inc.
304 Ivy Street
San Diego, CA 92101

Investigative Science and Engineering, Inc.
Scientific, Environmental, and Forensic Consultants

P.O. Box 488 / 1134 D Street
Ramona, CA 92065
(760) 787-0016
www.ise.us

ISE Project #10-013

August 19, 2010

REPORT CONTENTS

LIST OF TABLES

LIST OF FIGURES / MAPS / ADDENDA

INTRODUCTION AND DEFINITIONS

Existing Site Characterization

The subject project site consists of approximately 903 acres of privately owned, undeveloped agricultural land, in the unincorporated Mt. Signal area of the County of Imperial, approximately eight miles southwest of the City of El Centro (refer to Figure 1 on the following page). The property is located south of Anza Road, north of Cook Road, and is generally bisected by Pullman Road. The project site consists of six parcels, namely, Assessor Parcel Numbers (APN): 052-190- 021; 052-190-022; 052-190-023; 052-190-033; 052-190-034; and, 052-190-037.

The United States international border with the Republic of Mexico is located immediately south of the project site. Federal lands under jurisdiction of the Bureau of Land Management (BLM) are located immediately west of the project site. The property is designated by the County of Imperial General Plan as "Agriculture" and is zoned A-3 – Heavy Agriculture and A-2-R-General Agricultural Rural Zone. The site is currently utilized for alfalfa production as shown in Figure 2 on Page 3. Elevations across the site range from approximately 0 to 10 feet above mean sea level (MSL).

Project Description

The electricity generation process associated with the proposed project would utilize clean solar photovoltaic (PV) technology to convert sunlight directly into electricity. Under this technology, groups of photovoltaic modules are wired together to form a photovoltaic array. The PV arrays convert solar radiation into direct current (DC) electricity. The direct current from the array is collected at an inverter where the current is converted to phase and impedance adjusted alternating current (AC) for use within the electrical grid. The output from the inverter then flows through a step-up transformer before it reaches the transmission and distribution system. The proposed Imperial Solar Energy Center South site would have a nominal rated capacity of 200 megawatts (MW).

The major generation equipment comprising the photovoltaic electrical generation system includes PV solar modules; a panel racking and foundation design; inverter and transformer station; an electrical collection system; and a switchyard. The proposed design for the Imperial Solar Energy Center South site is shown in Figure 3 on Page 4 of this report.

Finally, the proposed photovoltaic facility site is located approximately five miles south of the existing Imperial Valley Substation. The photovoltaic facility would interconnect to the utility grid at the 230 kV side of the Imperial Valley Substation via an approximately five-mile long, 120-foot wide transmission line within lands maintained by the U.S. Bureau of Land Management.

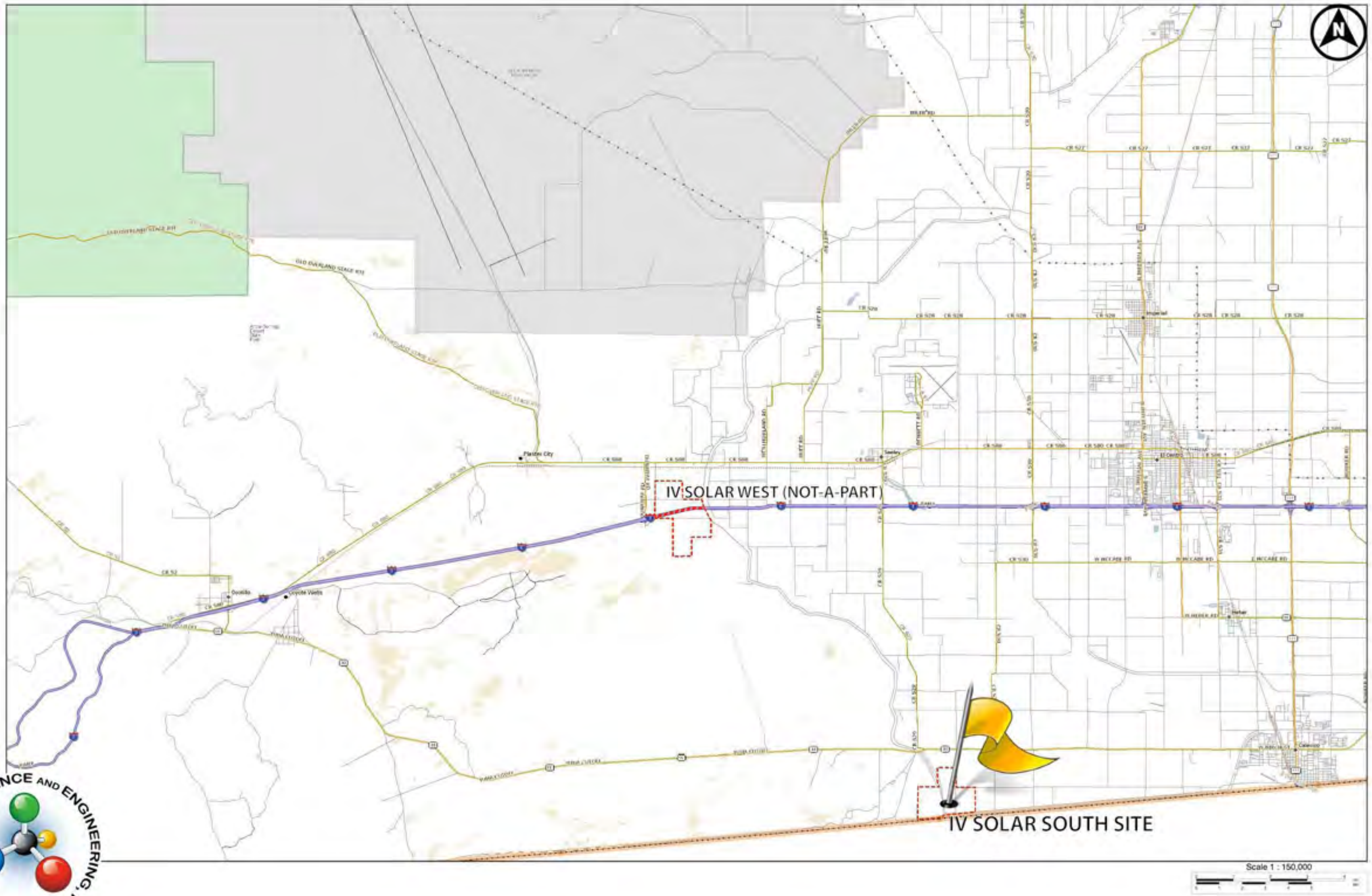


FIGURE 1: Project Area Vicinity Map (ISE 8/10)

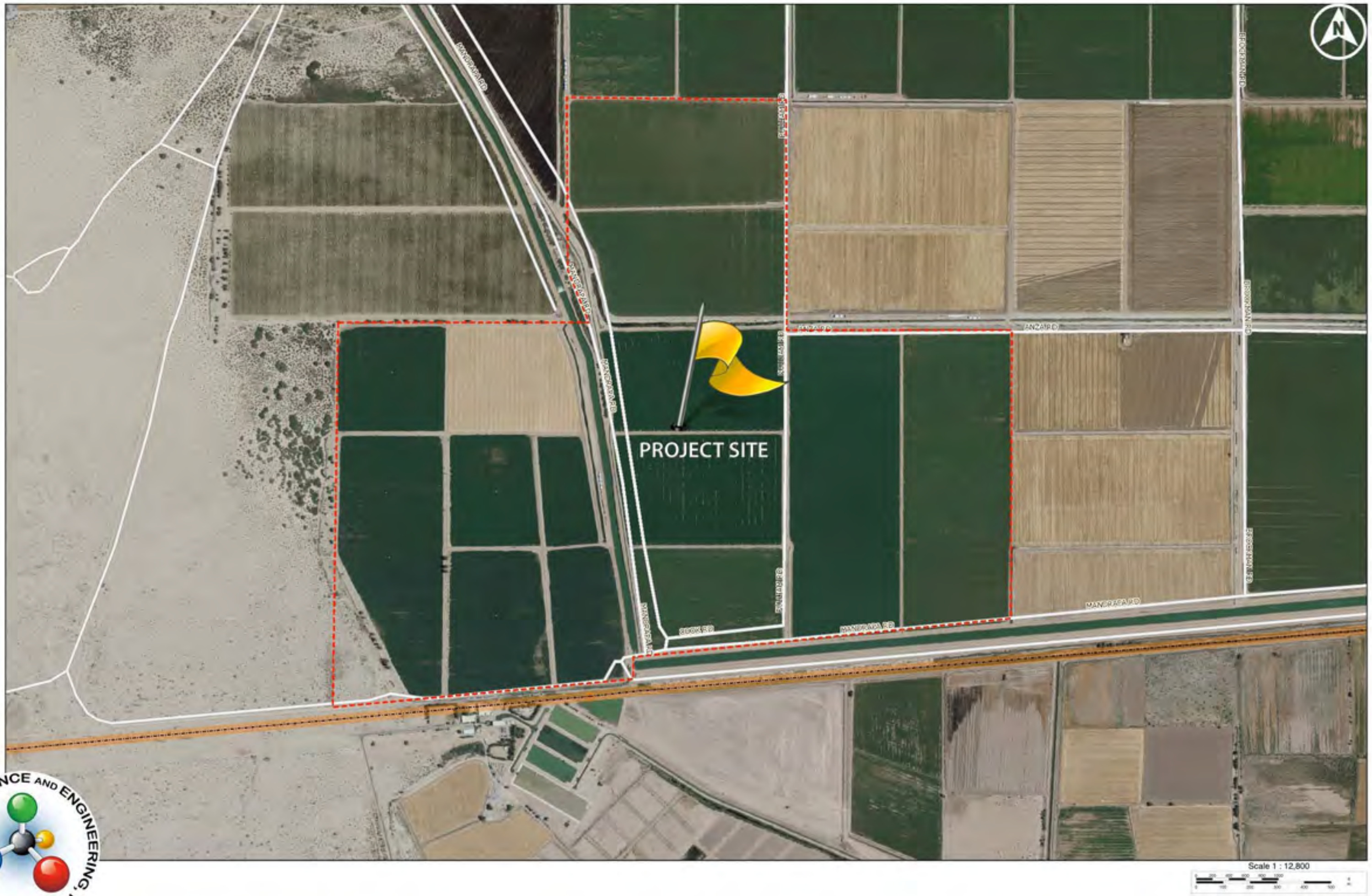


FIGURE 2: Imperial Solar Energy Center South Site Map (ISE 8/10)

FIGURE 3: Conceptual Facility Site Plan (Zachry Engineering 2010)

Historical Context of Global Warming Theories

Much recent conjecture has been postulated as to the effect of the so-called, 'Global Warming Phenomenon' or 'Greenhouse Gas Effect' and its correlation to anthropogenic 'Greenhouse Gas (GHG) Emissions'.[1] The debate began based upon initial observations that global surface temperatures have been perceived to be steadily increasing over the past century (i.e., the period for which competent and reliable measurements have been taken), with an increase of roughly 0.6 degrees Centigrade, as can be seen in the first pane of Figure 4 on the following page.[2,3,4]

Further examination of ice core records and tree ring data allowed researchers to probe far back in time to look at surface temperature variations over the past millennia (refer to the second pane of Figure 4).[5,6] The results would seem to indicate a noticeable increase in surface temperature over the past 100 years, occurring in roughly 1910 AD, becoming cyclically maximal around 1940 AD, and having a period of recurrence of slightly over 30 years.[7,8] This upward shift in temperature in a post-industrialized world was the impetus for all current global warming predictions.

---

[1] In fact, the notion that manmade (anthropogenic) global warming was a possibility has existed in written documentation since the early 1880's and been the subject of much chicanery within the realms of scientific fact as well as that of science fiction. Arguments have ranged from anecdotal cause-and-effect relationships to outright claims of disaster such as sea ice melting at great rates causing precipitous rises in global ocean levels (a clear violation of *Archimedes' principle* discovered over 2,200 years ago). It is safe to say that the dynamics of anthropogenic global warming and/or cooling is a less than well-defined field of science.

[2] The majority of this increase in temperature, which is formally expressed by the United Nations Intergovernmental Panel on Climate Change (IPCC) as *0.6 ± 0.2 degrees Centigrade*, occurred before 1940 AD, the generally accepted date when anthropogenic atmospheric CO_2 levels started any noticeable increase. The data presented in the first pane of Figure 5 provides information from surface temperature stations (red bars), as well as the annual average (the black trend line). The gray bars indicate the 95-percent confidence limits on the data. The black global temperature line (which is the basis of the whole global temperature increase argument) is only as good as the bounds of the gray tick-marks (which can have errors as large as, or larger than, the data point being represented).

[3] *Source:* IPCC, 2001, *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change* [Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson(eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 388-389.

[4] Recent developments in 2009 and early 2010 have cast these fundamental observations into doubt with the acknowledgement by the chief of the UK's *Hadley Centre for Climate Prediction and Research* (the creators of the modern theory of anthropogenic global warming) that critical scientific measurements which formed the foundation of current global warming hypotheses have been *'discarded'* and are *'unavailable'*, and cannot be replicated even by the Hadley Centre itself. In effect, the data that formed the basis of the 'theory' no longer exists.

[5] *Ibid.*

[6] The second pane of temperature trends from the IPCC report shows the same red bars (known temperature station data from the past 140 years), as well as a blue curve (which is a reconstructed temperature curve based upon ice cores and other natural evidence), and also a black curve, which is the 50-year moving average line. As in the previous graph pane, the gray marks indicate the 95-percent confidence intervals of the data. The IPCC report is very careful in its wording with respect to the historical reconstruction (which would indicate that over the past 1,000 years the temperature has been hotter, or colder, or neither – namely, it would be deemed as statistically meaningless by scientists). This graph is also known as the *'hockey-stick'* graph highly touted as conclusive proof of anthropogenic global warming. The UN has rewritten the findings of this graph between its First Working Group Report in 1990 to the most current Fourth Working Group Report in November 2007.

[7] Recent (2007) Microwave Sounding Unit (MSU) temperature measurements made from NOAA's polar-orbiting satellite platforms of the lower troposphere indicate a *cooling* of the planet despite an incremental increase in CO_2 levels. In fact, the same satellites have shown a steady *decrease* in temperature within the tropopause of 0.314 degrees Centigrade per decade since 1979. If the satellites can be trusted, this would indicate that the UN's original increase of 0.6 ± 0.2 degrees Centigrade has completely disappeared.

[8] In a purely historical context, this observation led then Prime Minister Margaret Thatcher, following the United Kingdom's (UK's) General Election of 1979, to adopt an obscure theory at the time for her pro-nuclear power generation platform: namely, the notion that Carbon Dioxide (CO_2) was the primary constituent to atmospheric warming, and that fossil-fuel {coal} burning power plants should be replaced with cleaner sources. Thus, at her insistence, the UK's Hadley Centre was formed to advance this theory. This center ultimately became the operating agency for the IPCC's scientific Working Group I in 1990, and the originating agency for all anthropogenic global warming hypotheses.

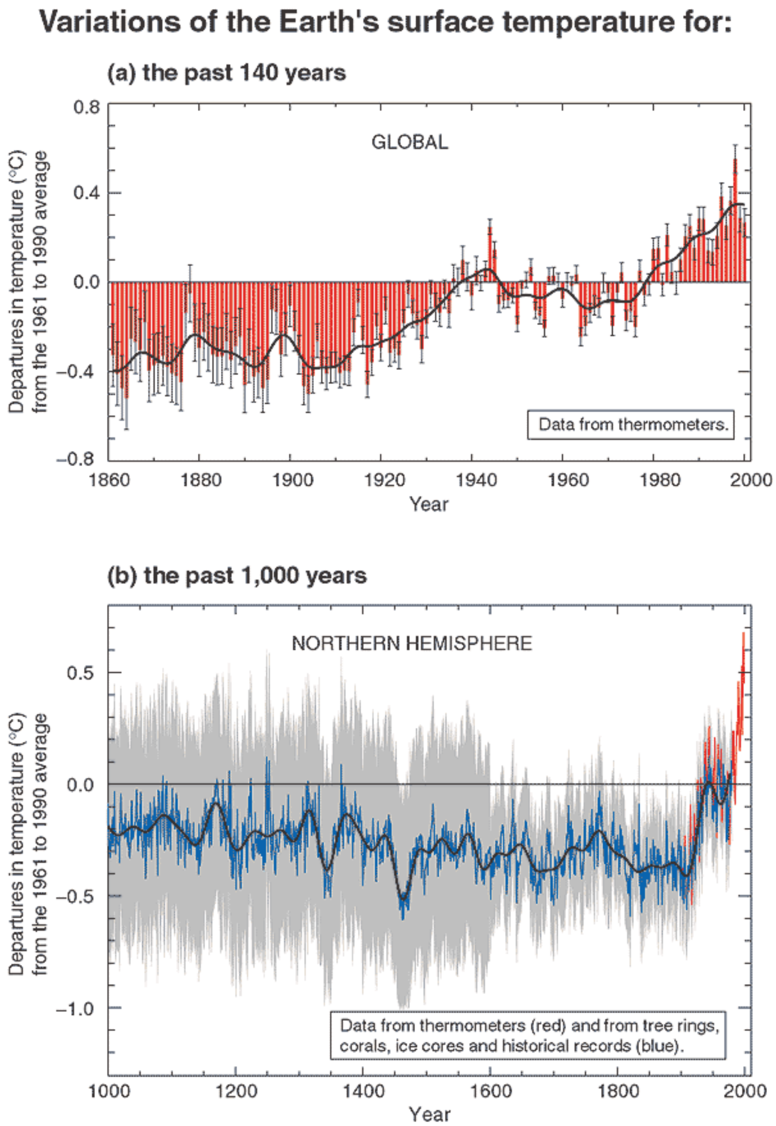


FIGURE 4: Measured/Predicted Global Temperature Variations (UN IPCC)[9]

[9] Reprinted exactly from the *Third Assessment Report of Working Group I* of the Intergovernmental Panel on Climate Change (IPCC), 2001.

Greenhouse Gases and Global Warming Potential

Greenhouse gases are defined by the IPCC as those naturally occurring and anthropogenic chemical compounds within the atmosphere that absorb and reflect infrared radiation emitted by the Earth's surface.[10] A numerical metric known as the *'Global Warming Potential'* (GWP) is a measure of how much a given mass of greenhouse gas is estimated to contribute to global warming relative to pure carbon dioxide (whose GWP is normalized at 1.0).

A complete listing of known greenhouse gases and their associated GWP is shown in Table 1, starting on the following page. Examples of the more prevalent gases are detailed below:

- Carbon dioxide (CO_2): CO_2 is a naturally occurring gas and is part of the *carbon cycle,* whereby carbon is cycled between the atmosphere, ocean, terrestrial life, and mineral reserves. The predominant source of anthropogenic carbon dioxide emissions is from the combustion of fossil fuels and hydrocarbons. Without CO_2, all life on Earth would cease to exist. Carbon Dioxide is the reference gas against which all other greenhouse gases are compared. It makes up approximately 3.6 percent of the global warming gases in the atmosphere today.

- Water Vapor (H_2O): Water is a chemical compound that is essential to all known forms of life and has been denoted as '*the universal solvent*'. Water vapor is the gaseous form of water comprising roughly 0.001% of all water on the planet. Without H_2O, all life on Earth would cease to exist. Water vapor captures roughly 10 times as much infrared energy as CO_2.[11] Water vapor makes up approximately 95 percent of the global warming gases in the atmosphere today.

- Methane (CH_4): CH_4 is a greenhouse gas with both natural and anthropogenic sources and is believed to have been the primary atmospheric constituent of primordial Earth. Methane is naturally produced by the anaerobic decomposition of organic matter. Methane is also emitted during the production and distribution of natural gas and petroleum, and is released as a by-product of incomplete {low-temperature} fossil fuel combustion. It is estimated that a little more than half of the current methane emissions to the atmosphere are from anthropogenic sources. Methane constitutes approximately 0.36 percent of the global warming gases in the atmosphere today.

- Nitrous Oxide (N_2O): Primarily, N_2O is naturally produced by bacterial action within the soil, and anthropogenically by high temperature combustion. The result is more-or-less the production of photochemical smog. Lesser sources, such as manufacturing, wastewater treatment, and biomass burning, also produce trace amounts of this substance. N_2O constitutes approximately 0.95 percent of the global warming gases in the atmosphere today.

- Halocarbons (CFC's) / Perfluorocarbons (PFC's) are carbon compounds that contain fluorine, chlorine, bromine or iodine. Anthropogenic sources are the primary generator of these substances. These gases constitute roughly 0.072 percent of the global warming gases in the atmosphere today.

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[10] The basic mechanism can be summarized as follows: 1) solar radiation heats the planet primarily through ultraviolet and higher energy transmission, 2) Earth gets warm and is offset by temperature levels in the oceans (which act as a global thermostat), 3) Earth emits black-body radiation in the lower infrared portion of the electromagnetic spectrum, 4) most of the infrared radiation escapes the planet in accordance with the First Law of Thermodynamics, 5) a small portion of the energy is captured through molecular motion changes within the atmospheric greenhouse gases, and 6) this captured energy re-radiates back toward Earth (and interstellar space) producing a secondary heating effect. However, despite its name, this is not the same mechanism by which a greenhouse operates.

[11] The IPCC scientific panel states that about half of the projected global temperature increase from CO_2 is due to what is referred to as the *water vapor feedback effect*. Water vapor feedback is caused by the radiative efficiency of H_2O in vaporous form (i.e., its GWP). The UN IPCC report neglects to present this value.

TABLE 1: Known Greenhouse Gases and Global Warming Potential[12]

Pollutant Name	Chemical Formula	GWP Relative to CO_2 (100 year horizon)
Carbon Dioxide	CO_2	1
Dibromomethane	CH_2Br_2	1
R-13I1 (Trifluoroiodomethane)	$FIC\text{-}13I_1$	1
R-E170 (Dimethyl ether)	CH_3OCH_3	1
Methyl Bromide	CH_3Br	5
Dichloromethane	CH_2Cl_2	10
R-161 (HFC-161, Fluoroethane)	HFC-161	12
R-40 (Methyl Chloride)	CH_3Cl	16
Methane	CH_4	23
Chloroform	$CHCl_3$	30
2,2,3,3,3-Pentafluoro-1-propanol	$CF_3CF_2CH_2OH$	40
R-152 (HFC-152, 1,1-Difluoroethane)	HFC-152	43
2,2,2-Trifluoro-ethanol	$(CF_3)CH_2OH$	57
R-41 (HFC-41, Methyl fluoride)	HFC-41	97
R-123 (HCFC-123, Dichlorotrifluoroethane)	HCFC-123	120
R-152a (HFC-152a, 1,1-Difluoroethane)	HFC-152a	120
1,1,1-Trichloroethane	CH_3CCl_3	140
1,1,1,3,3,3-Hexafluoro-2-Propanol	$(CF_3)_2CHOH$	190
R-21 (Dichlorofluoromethane)	HCFC-21	210
Nitrous Oxide	N_2O	296
HFC-143, 1,1,2-Trifluoroethane	HFC-143	330
Methyl perfluoroisopropyl ether	$(CF_3)_2CFOCH_3$	330
Bromodifluoromethane	$CHBrF_2$	470
R-32 (HFC-32, Difluoromethane)	HFC-32	550
R-124 (HCFC-124, 2-Chloro-1,1,1,2-Tetrafluoroethane)	HCFC-124	620
R-141b (HCFC-141b, 1,1-Dichloro-1-fluoroethane)	HCFC-141b	700
HFE-143a	HFE-143a	750
HFC-134, 1,1,2,2-Tetrafluoroethane	HFC-134	1,100
R-12B1 (Difluorochlorobromomethane, Halo 1211)	Halon-1211	1,300
R-134a (HFC-134a, 1,1,1,2-Tetrafluoroethane)	HFC-134a	1,300
R-22 (Chlorodifluoromethane)	HCFC-22	1,700
Carbon Tetrachloride	CCl_4	1,800
R-142b (HCFC-142b, 1-Chloro-1,1-difluoroethane)	HCFC-142b	2,400
R-143a (HFC-143a, 1,1,1-Trifluoroethane)	HFC-143a	4,300
R-11 (Trichlorofluoromethane)	CFC-11	4,600
R-14 (Carbon Tetrafluoride)	CF_4	5,700
R-113 (1,1,2-Trichloro-1,2,2-Trifluoroethane)	CFC-113	6,000
R-E134 (HFE-134, 1,1,1',1'-Tetrafluorodimethyl ether)	HFE-134	6,100
R-13B1 (Trifluorobromomethane, Halo 1301)	$CBrF_3$	6,900
R-115 (Chloropentafluoroethane)	CFC-115	7,200
C_3F_8 (Perfluoropropane)	C_3F_8	8,600

[12] Source: *Climate Change 2001: The Scientific Basis*. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change, IPCC 2001.

TABLE 1 (cont.): Known Greenhouse Gases and Global Warming Potential[13]

Pollutant Name	Chemical Formula	GWP Relative to CO_2 (100 year horizon)
C_4F_{10} (Perfluoro-n-Butane)	C_4F_{10}	8,600
C_5F_{12} (Perfluoropentane)	C_5F_{12}	8,900
C_6F_{14} (Perfluorohexane)	C_6F_{14}	9,000
R-114 (Freon 114, 1,2-Dichlorotetrafluoroethane)	CFC-114	9,800
R-C318 (Freon 318, Octafluorocyclobutane)	C-C_4F_8	10,000
R-12 (Freon 12, Dichlorodifluoromethane)	CFC-12	10,600
Nitrogen Trifluoride; Trifluoramine	NF_3	10,800
R-116 (Perfluoroethane; Hexafluoroethane)	C_2F_6	11,900
R-23 (HFC-23, Trifluoromethane)	HFC-23	12,000
R-13 (Chlorotrifluoromethane)	CFC-13	14,000
R-E125 (HFE-125, Pentafluorodimethyl ether)	HFE-125	14,900
Sulfur Hexafluoride	SF_6	22,200

Naturally occurring greenhouse gases include the aforementioned carbon dioxide (CO_2), water vapor (H_2O), methane (CH_4), nitrous oxide (N_2O), and ozone (O_3). In addition, several classes of halogenated substances that contain fluorine, chlorine, or bromine also demonstrate a 'greenhouse' gas potential. Examples of these pollutants are halocarbons, perfluorocarbons (PFC's), and sulfur hexafluoride (SF_6), etc.

THRESHOLDS OF SIGNIFICANCE

California Environmental Quality Act (CEQA) Thresholds

Section 15382 of the California Environmental Quality Act (CEQA) guidelines defines a significant impact as,

> *"… a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance."*

Senate Bill 97 (2007) set a January 1, 2010, deadline for new CEQA guidelines related to greenhouse gas emissions analysis and mitigation.[14] The new guidelines will require GHG emissions and their effects to be analyzed based on scientific and factual data.[15] The new guidelines do not require CEQA to establish fixed thresholds of significance, rather they serve to update the procedural language of Section 15064(a) leaving individual significance criteria to local agencies.

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[13] Source: *Climate Change 2001: The Scientific Basis*. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change, IPCC 2001.

[14] An act to add Section 21083.05 to, and to add and repeal Section 21097 of, the Public Resources Code, relating to the California Environmental Quality Act.

[15] This is consistent with all past and present ISE Greenhouse Gas / Global Warming Risk Assessments.

The California Global Warming Solutions Act (AB 32)

The California State Legislature, operating under the assumption that anthropogenic global warming is a genuine phenomenon, and that atmospheric carbon dioxide is the most significant contributor to this phenomenon, passed the *California Global Warming Solutions Act of 2006* (AB 32). AB 32 requires the California Air Resources Board (CARB) to develop regulations and market mechanisms that will ultimately reduce California's greenhouse gas emissions by 25 percent by 2020. Mandatory caps will begin in 2012 for significant sources, and will incrementally become stricter to meet the 2020 goals.

Specifically, AB 32 requires CARB to:

1) Establish a statewide greenhouse gas emissions cap for 2020, based on 1990 emissions by January 1, 2008.
2) Adopt mandatory reporting rules for significant sources of greenhouse gases by January 1, 2009.
3) Adopt a plan by January 1, 2009 indicating how emission reductions will be achieved from significant greenhouse gas sources via regulations, market mechanisms and other actions.
4) Adopt regulations by January 1, 2011 to achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas, including provisions for using both market mechanisms and alternative compliance mechanisms.
5) Convene an Environmental Justice Advisory Committee and an Economic and Technology Advancement Advisory Committee to advise CARB.
6) Ensure public notice and opportunity for comment for all CARB actions.
7) Prior to imposing any mandates or authorizing market mechanisms, CARB must evaluate several factors, including but not limited to, impacts on California's economy, the environment and public health; equity between regulated entities; electricity reliability; conformance with other environmental laws; and that the rules do not disproportionately impact low-income communities.

For the purposes of analysis within this report (and to be completely consistent with AB 32), it will be sought to, 1) quantify the aggregate greenhouse gas emissions due to the proposed project action, and, 2) quantify the net heating effect within the State of California.

ANALYSIS METHODOLOGY

Greenhouse Gas Compilation Approach

Diesel Powered (Compression Ignition) Equipment Contribution

Greenhouse gas emissions associated with diesel engine combustion from mass grading construction equipment will be assumed to occur for engines running at the correct fuel to air ratios.[16] Of principal interest are the emission factors for CO_2 and NO_X[17]. For a four-stroke diesel-cycle engine, the combustion byproducts are approximately 1.5-percent-by-volume O_2, 0.5-percent-by-volume CO, and 13.5-percent-by-volume CO_2.[18] Thus, the ratio of CO_2 to CO production in a properly mixed diesel stroke would be 13.5/0.5 or 27:1.

Operational Motor Vehicle (Spark Ignition) Contribution

CARB estimates on-road motor vehicle emissions by using a series of models called the *Motor Vehicle Emission Inventory* (MVEI) Models. The four computer models, which form the MVEI, are *CALIMFAC, WEIGHT, EMFAC*, and *BURDEN*.[19] For the current analysis, the *EMFAC 2007 Model v2.3* of the MVEI[20] was run using input conditions specific to the Salton Sea air basin to predict operational vehicle emissions from the project based upon a project completion scenario year of 2012.[21] The aggregate greenhouse emission factors from the CARB *EMFAC 2007* model are provided as an attachment to this report. Of principal interest are the emission factors for CO_2 and NO_X.

A mix ratio consistent with the Caltrans ITS Transportation Project-Level Carbon Monoxide Protocol was used. This consisted of the following air standard Otto-Cycle engine vehicle distribution percentages: Light Duty Autos (LDA) = 69.0%, Light Duty Trucks (LDT) = 19.4%, Medium Duty Trucks (MDT) = 6.4%, Heavy Duty Trucks (HDT) = 4.7%, Buses (UBUS) = 0.0% and Motorcycles (MCY) = 0.5%.

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[16] The ratio whereby complete combustion of the diesel fuel occurs.

[17] It will be assumed that the project would generate trace-, if not negligible-, levels of methane (CH_4), ozone (O_3), fluorine (F_2), chlorine (Cl_2), bromine (Br_2) and/or constituent compounds. NO_x emissions are stoichiometrically composed of roughly 30-percent nitrous oxide (N_2O) by volume and 70-percent nitric oxide (NO), which is the free radical form that immediately combines with ozone (O_3) to form nitrogen dioxide (NO_2) more commonly known as *smog*.

[18] Source: Holtz, J.C., Elliott, M.A., *The Significance of Diesel-Exhaust-Gas Analysis, Transactions of the ASME, Vol. 63, February 1941*.

[19] CALIMFAC produces base emission rates for each model year when a vehicle is new, and as it accumulates mileage and the emission controls deteriorate. WEIGHT calculates the relative weighting each model year should be given in the total inventory, and each model year's accumulated mileage. EMFAC uses these pieces of information, along with the correction factors and other data, to produce fleet composite emission factors. BURDEN combines the emission factors with county-specific activity data to produce to emission inventories.

[20] This is the most current CARB vehicle emissions model approved for use within the State of California. Any subsidiary program (such as the previously discussed *URBEMIS* program) uses this model to determine the applicable vehicle emission factors.

[21] This is a worst-case assumption, since implementation of cleaner vehicle controls ultimately reduces emissions under future year conditions. By applying near-term emission factors to the complete project, an upper bound on project-related emissions is obtained.

Projected Greenhouse Gas Emissions Budget and Warming Effects Analysis

To address the net greenhouse gas emissions and perceived global warming potential of the project per AB 32, the entire State of California will be modeled as a thermodynamically closed system, subject only to increasing CO_2 concentrations and their equivalents (denoted as CO_{2e}).[22] This approach creates a type of *Urban Heat Island* dependant only on CO_{2e}, whereby the effective temperature increase on the State due to the proposed project action can be quantified using the exact methodology identified in the U.N.'s Third Assessment Report of the IPCC.[23]

The analysis presented herein is consistent and in accordance with the *First Law of Thermodynamics* and the intent of AB 32.[24] Mitigation measures consistent with the State of California's policy implementation of AB 32 will be provided at the end of the report.

FINDINGS

Greenhouse Gas Emission Tabulation

Diesel Powered (Compression Ignition) Equipment Contribution

The Imperial Solar Energy Center South project would utilize a contingency of equipment required to grade and prepare the site for a period of roughly 340 to 360 days (i.e., ±17 months).[25] The work would be roughly distributed across three different phases of approximately 120-days each).

Previous analysis of the required equipment and subsequent emissions budget has been examined within the project's *Air Quality Conformity Assessment*.[26] The pertinent findings are shown in Table 2 on the following page.

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[22] Since the California legislature's concern about the possible contribution of human activities to global warming was the impetus for the AB-32 legislation, and since this bill incorporates statewide reductions in greenhouse gas emissions to attempt to combat this potential issue, thorough discussions of both greenhouse gas emissions and global warming risk potential must be included in any complete report on the subject.

[23] An Urban Heat Island (or UHI) is a developed area that is significantly warmer than its undeveloped surroundings. The temperature difference usually is larger at night than during the day, and larger in winter than in summer, due to the re-radiation of solar energy by paved surfaces and buildings, and waste heat generated by energy usage and building heating and cooling. Water vapor will be completely ignored from the analysis (as is done in the United Nations source document).

[24] Simply expressed, the *First Law of Thermodynamics* states that for any thermodynamic system, the sum of the heat 'h' contained within the system (or that it receives), plus the work 'w' that the system is capable of (or receives) is equal to the total internal energy 'E' of the system. The first law of thermodynamics basically states that a thermodynamic system can store energy in two different forms (namely heat and/or work) and that this internal energy is conserved.

[25] The analysis of GHG emissions, unlike air quality conformity, which is a 'per day' threshold, is an aggregate quantity requiring summation over the total estimated number of work days (i.e., the total number of days that any construction grading vehicle would have an engine running).

[26] Source: *Construction Air Quality Conformity Assessment – Imperial Solar Energy Center South – Imperial County, CA, ISE Project #10-013, Investigative Science and Engineering, Inc., 8/17/10.*

TABLE 2: Construction Vehicle GHG Emissions – Imperial Solar Energy Center South (Tier 2+)

Construction Phase	Equipment Classification	Construction Vehicle Emission Levels (in pounds) (Per day from AQIA Report) CO	NOx	(Total Over Construction Period) $CO_2 = 27 \cdot CO$	$N_2O = 0.3 \cdot NO_X$
Grading / Clearing / Hauling (Mitigated Tier 2+)					
	Dozer - D8 Cat	6.8	7.9	22,032.0	284.4
	Loader	4.9	4.0	15,876.0	144.0
	Water Truck	4.6	5.3	14,904.0	190.8
	Dump/Haul Trucks	5.5	6.3	17,820.0	226.8
	Scraper	7.7	8.9	24,948.0	320.4
Underground Utility / Transmission Line					
	Track Backhoe	3.7	6.8	11,988.0	244.8
	Loader/Drill	3.7	6.8	11,988.0	244.8
	Water Truck	4.6	12.2	14,904.0	439.2
	Concrete Truck	1.4	3.8	4,536.0	136.8
	Dump/Haul Trucks	6.2	16.4	20,088.0	590.4
PV System Installation / Tower Placement					
	Skid Steer Cat	3.7	6.8	11,988.0	244.8
	Hydraulic Crane	2.3	6.1	7,452.0	219.6
	Dump/Haul Trucks	1.5	4.1	4,860.0	147.6
	Paver	3.4	6.4	11,016.0	230.4
	Roller	3.4	6.4	11,016.0	230.4
			SUM (Σ):	**205,416.0**	**3,895.2**

Since N_2O has a GWP of 296 with respect to CO_2, this result can be expressed as an *equivalent* CO_2 level (sometimes denoted as CO_{2e}) of 1,152,979.2 pounds. Thus, the final equivalent CO_2 GHG load due to the project would be the summation of this value and the direct CO_2 production shown in Table 2, or 1,358,395.2 pounds CO_{2e}, during construction activities.

Construction Motor Vehicle (Spark Ignition) Contribution

Motor vehicles are the primary source of greenhouse gas emissions associated with the proposed project development. Typically, vehicular trips to and from these land uses are the significant contributor of greenhouse gases. The aggregate project emission levels are shown in Table 3 on the following page. The proposed project site is expected to have a total construction trip generation level of 680 ADT.[27] The average vehicle trip length would be 15 miles, with a median running speed of 45 MPH.

[27] Source: *Imperial Solar Energy Center South – Draft Traffic Impact Analysis, LOS Engineering, Inc., 8/2/10.*

TABLE 3: Construction Vehicle GHG Levels – Imperial Solar Energy Center South

Vehicle Classification	Trip ADT	Total Emissions (pounds per day) CO_2	N_2O
Light Duty Autos (LDA)	469	4,428.6	1.5
Light Duty Trucks (LDT)	132	1,560.4	0.7
Medium Duty Trucks (MDT)	44	698.7	0.3
Heavy Duty Trucks (HDT)	32	1,719.7	3.5
Buses (UBUS)	0	0.0	0.0
Motorcycles (MCY)	3	14.4	0.1
Total (Σ):	**680**	**8,421.7**	**6.0**

Again, since N_2O has a GWP of 296 with respect to CO_2, the *equivalent* CO_{2e} level would be 1,776.0 pounds for N_2O. The final equivalent daily CO_{2e} load due to vehicular traffic would be 10,197.7 pounds. Assuming a worst-case 360-day construction period, the CO_{2e} load would be 3,670,920 pounds.

Projected Project Greenhouse Gas Emissions Budget

The projected greenhouse gas emission budget for the proposed project would be the summation of the individual sources identified under the previous section. Thus, the total budget would equate to the following levels shown in Table 4, below.

TABLE 4: GHG Emission Budget for Imperial Solar Energy Center South

Project Scenario	CO_{2e}	Pounds per ...
Construction Equipment Operations	1,358,395	total construction period
Construction Vehicle Operations	3,670,920	total construction period

The total aggregate construction GHG emissions inclusive of all vehicular travel would therefore be 5,029,315 pounds of CO_{2e}.

Projected Warming Effects Due to Project Equivalent CO_{2e}

Finally, since AB 32 is formally known as the *California Global Warming Solutions Act*, it is of scientific interest to identify the level of warming predicted by construction and operation of the proposed project action and its effect on the State of California in terms of theoretical heating and the time for the project to manifest as any appreciable climate change according the U.N.'s Third Assessment Report of the IPCC.[28]

Given this, the proposed Imperial Solar Energy Center South project would contribute a total of 5,029,315 pounds of CO_{2e} due to construction activities. Assuming all CO_{2e} mixing occurs within the Troposphere[29], the thermodynamic system consisting of the boundaries of the State of California would have a volume[30] of,

$$V_{\substack{\text{system} \\ \scriptscriptstyle California}} = 104,765,440 \text{ acres} \times \frac{43{,}560 \text{ sq-ft}}{\text{acre}} \times 37,000 \text{ ft} = 1.6884x10^{17}\,\text{ft}^3$$

Since one part-per-million-by-volume (ppmv) of CO_2 equals 1.12315x10^{-7} pounds-per-cubic-foot at *Standard Temperature and Pressure* (STP), the increase in CO_{2e} concentration due to construction of the proposed project action within the State of California would be,

$$\text{CO}_{\text{Conc}_{\text{System}}} = \frac{5{,}029{,}315 \text{ pounds}}{1.6884\text{x}10^{17}\ \text{ft}^3} \times \frac{1\text{ ppmv CO}_2}{1.12315\text{x}10^{-7}\ \frac{\text{pounds}}{\text{ft}^3}\text{@STP}} = 2.65x10^{-4}\,\text{ppmv}$$

This equates to a 0.000265 ppmv CO_{2e} increase within our tropospheric system bounded by the land mass limits of the State of California. The net change in radiative forcing due to a change in CO_{2e} is defined within the IPCC report[31] as,

$$\Delta F = \alpha\ Ln\left(\frac{C}{C_0}\right)$$

where,
ΔF is the change in the radiative forcing (in W/m^2),
α is the atmospheric forcing coefficient = 5.35, [32]
C is the baseline plus project CO_2 and CO_{2e} concentrations (in ppmv), and,
C_0 is the baseline CO_2 concentration (commonly taken as 380 ppmv).

[28] This is, of course, the entire point behind the legislative mandate of AB 32, namely to reduce the global warming effects produced by the State of California.

[29] The troposphere is the lowest portion of Earth's atmosphere and contains approximately 75% of the atmospheric mass of the planet and almost all of its water vapor and GHG's. The average depth of the troposphere is approximately seven miles (≈37,000 feet). For the purposes of analysis we will assume that all mixing occurs at sea level (which produces the greatest atmospheric concentrations and subsequent radiative forcing).

[30] The area within the State of California is approximately 163,696 square miles (104,765,440 acres) which, when multiplied by the height of the tropopause, roughly equates to 1.6884x10^{17} ft^3. This is also the jurisdictional boundary of AB 32.

[31] Source: *Third Assessment Report of Working Group I* of the Intergovernmental Panel on Climate Change (IPCC), 2001.

[32] Based on carbon dioxide contributing approximately 32 watts per square-meter (W/m^2) of long-wave radiative forcing to the climate system under a clear-sky condition, out of a total of 125 watts per square-meter for all atmospheric gases under the same conditions. The total radiative forcing from the Sun as of 1997 was 342 W/m^2.

Furthermore, surface air temperature sensitivity factors cited by the IPCC have a global average of approximately 0.1 °C/W/m^2. Thus, the net yearly increase in temperature for the first year of operation due to the proposed project CO_{2e} emissions would be,

$$
\begin{aligned}
\Delta T_{\text{Project}(year=1)} &= 0.1\frac{^{\circ}\mathrm{C}}{\mathrm{W/m^2}} \times 5.35 Ln\left(\frac{380 + 0.000265}{380}\right) W\!\big/\!_{\mathrm{m}^2} \\
&= 0.1\frac{^{\circ}\mathrm{C}}{\mathrm{W/m^2}} \times 5.35 Ln\left(\frac{380.000265}{380}\right) W\!\big/\!_{\mathrm{m}^2} \\
&= 3.7309x10^{-7}\ ^{\circ}\mathrm{C}
\end{aligned}
$$

Looking at this another way, it would take the combined construction effort of 2,680,304 projects like the proposed Imperial Solar Energy Center South development to raise the temperature in the State of California by one-degree Centigrade.[33]

CONCLUSIONS / RECOMMENDATIONS

Project-Related Greenhouse Gas Budget / Global Warming Potential

The proposed Imperial Solar Energy Center South project site was shown to produce an aggregate equivalent greenhouse gas loading of 5,029,315 pounds of CO_{2e}. The cumulative warming effect due construction of the project was found to be 3.7309x10^{-7} °C, which would be deemed as cumulatively considerable and mitigable under CEQA. The net contribution to planet Earth as a whole would be deemed insignificant.[34]

Compliance with AB 32 CO_2 Reduction Strategies

Consistent with the intent of AB 32, the proposed project should demonstrate that it has policies in place that would assist in providing a statewide reduction in CO_2 as compared to ‘business as usual’. To this end, the following greenhouse gas offset measures starting on the following page have been shown to be effective by CARB and should be implemented <u>wherever possible</u>.

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[33] The one-degree Centigrade point is the current threshold discussed in the scientific literature whereby a perceivable change in the affected environment is expected. As can be seen, the proposed project would produce an extremely small, but measurable change in the affected environment following the IPCC’s scientific model.

[34] Ninety-percent (90%) of the atmosphere of the planet Earth resides within 16 kilometers (16,000 meters) of the surface. Thus, the volume of the atmosphere is roughly 8.2x10^9 km^3 (8.2x10^{18} m^3 or 2.9x10^{20} ft^3). The mass of the atmosphere is roughly 5.3x10^{21} grams or 1.17x10^{19} pounds. Although the project’s contribution is mathematically a finite number, it is also asymptotically driven to zero in its bounded limit. Thus, the net temperature contribution of the proposed project to the planet as a whole is physically zero, and in fact could not even be directly measured using modern scientific instrumentation.

Diesel Equipment (Compression Ignition) Offset Strategies (40% to 60% Reduction):

1) Use electricity from power poles rather than temporary diesel power generators.
2) Construction equipment operating onsite should be equipped with two to four degree engine timing retard or precombustion chamber engines.
3) Construction equipment used for the project should utilize EPA Tier 2 or better engine technology.

Vehicular Trip (Spark Ignition) Offset Strategies (30% to 70% Reduction):

4) Encourage commute alternatives by informing construction employees and customers about transportation options for reaching your location (i.e. post transit schedules/routes).
5) Help construction employees rideshare by posting commuter ride sign-up sheets, employee home zip code map, etc.
6) When possible, arrange for a single construction vendor who makes deliveries for several items.
7) Plan construction delivery routes to eliminate unnecessary trips.
8) Keep construction vehicles well maintained to prevent leaks and minimize emissions, and encourage employees to do the same.

CERTIFICATION OF ACCURACY AND QUALIFICATIONS

This report was prepared by Investigative Science and Engineering, Inc. (ISE), located at 1134 D Street, Ramona, CA 92065. The members of its professional staff contributing to the report are listed below:

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ISE affirms to the best of its knowledge and belief that the statements and information contained herein are in all respects true and correct as of the date of this report. Should the reader have any questions regarding the findings and conclusions presented in this report, please do not hesitate to contact ISE at (760) 787-0016.

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Project Principal
Investigative Science and Engineering, Inc. (ISE)

APPENDICES / SUPPLEMENTAL INFORMATION

EMFAC 2007 EMISSION FACTOR TABULATIONS – SCENARIO YEAR 2012

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Title    : Salton Sea Air Basin Avg Winter CYr 2012
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2010/08/17 16:56:09
Scen Year: 2012 -- All model years in the range 1968 to 2012 selected
Season   : Winter
Area     : Salton Sea
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     Year: 2012 -- Model Years 1968 to 2012 Inclusive -- Winter
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

         Salton Sea                        Basin Average                 Basin Average

                         Table   1:  Running Exhaust Emissions (grams/mile)

     Pollutant Name: Oxides of Nitrogen        Temperature:  50F  Relative Humidity:  40%
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Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
10	0.497	0.832	1.043	20.494	20.799	1.323	3.616
15	0.441	0.733	0.924	15.026	17.922	1.321	2.743
20	0.400	0.660	0.839	12.828	16.183	1.330	2.369
25	0.369	0.607	0.781	12.188	15.217	1.348	2.239
30	0.346	0.571	0.743	11.688	14.822	1.373	2.141
35	0.331	0.548	0.724	11.324	14.899	1.406	2.072
40	0.322	0.536	0.720	11.097	15.422	1.446	2.031
45	0.319	0.535	0.732	11.008	16.436	1.492	2.019
50	0.322	0.545	0.760	11.061	18.066	1.546	2.035
55	0.330	0.567	0.809	11.261	20.552	1.607	2.082
60	0.344	0.602	0.882	11.620	24.318	1.676	2.162
65	0.365	0.654	0.988	12.155	30.108	1.755	2.281

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     Pollutant Name: Carbon Dioxide            Temperature:  50F  Relative Humidity:  40%
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Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
10	715.250	890.931	1243.611	2960.255	2200.775	211.297	1156.302
15	561.060	699.643	964.326	2440.839	1924.268	182.219	923.608
20	456.795	570.291	779.665	2066.999	1755.907	161.072	763.430
25	386.001	482.464	656.466	1935.851	1651.273	145.950	672.970
30	338.535	423.577	574.984	1827.178	1586.087	135.620	609.403
35	308.149	385.880	523.386	1739.860	1546.861	129.335	566.170
40	291.108	364.740	494.755	1673.286	1526.214	126.727	539.379
45	285.418	357.680	485.463	1627.152	1520.514	127.770	526.963
50	290.428	363.896	494.378	1601.380	1528.790	132.801	528.261
55	306.711	384.096	522.624	1596.085	1552.454	142.598	543.884
60	336.168	420.640	573.823	1611.617	1595.713	158.562	575.841
65	382.406	478.003	654.915	1648.662	1666.833	183.036	627.949

INDEX OF IMPORTANT TERMS